

РЕФЕРАТ

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METHODS AND MEANS OF AUTOMATIC ADJUSTMENT OF AMPLITUDES OF HARMONIC SIGNALS IN SYSTEMS OF MEASUREMENT OF SMALL PHASE SHIFTS

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When measuring small phase shifts between harmonic signals to reduce the additive error, it is necessary to equalize their amplitudes.

In the article the offered automatic scheme of equalization of amplitudes (SEoA) of the compared signals on the basis of the controlled voltage divider is considered. The controlled resistance of the voltage divider is made on a unipolar field-effect transistor. Computer simulation of such SEoA was performed and the accuracy of amplitude alignment was evaluated.

The use of a field-effect transistor in a controlled divider has proven the effectiveness of the proposed SEoA, but this solution is not the best. The nonlinearity of the resistance of the field-effect transistor significantly limits both the dynamic range of changes in the difference of the amplitudes of the input signals, and the accuracy of the alignment of the amplitudes of the signals at the output of the SEoA. The estimate of the relative error of amplitude alignment was 0.4 %.

The ways to improve the characteristics of SEoA are pointed. In particular, the installation of a selective amplifier at the output of the differential circuit (DC). It is hoped that the estimate of the minimum value of the error will not be worse than 0.1 %.

The best results in accuracy and dynamic range can be obtained by using a photoresistor as a controlled resistor. It has a range of resistance changes and linearity characteristics are much higher than the field-effect transistor.

Reducing the amplitudes of the input signals impairs the operation of the rectifiers at the output of both dividers. Therefore, at low levels of input signals before the rectifiers SEoA should use amplifiers.

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DETERMINATION OF PARAMETERS OF RECURRENT LOGARITHMIC ANALOG-DIGITAL CONVERTERS

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Research methodology. The methodological basis of the study is represented by the principles of reliability and scientific objectivity, based on the priority of published materials. The study used scientific methods of comparison, generalization, analysis and synthesis. The study used scientific methods of comparison, generalization, analysis and synthesis. This made it possible to identify the most significant in the studied methods and means of transformation and to ensure the completeness of their consideration.

Results. The study summarizes the principles of construction of recurrent logarithmic ADCs. The relationships between the basis of the logarithm, the dynamic range and the error and the conversion time are analyzed. The conclusion and generalizations are confirmed by the involved list of primary sources.

Novelty. The scientific novelty of the obtained results is the introduction of a variable in the process of transforming the basis of the logarithm. This allows the selected bit rate of the recurrent logarithmic ADC to obtain a higher 2–4 binary conversion accuracy.

Practical Significance. The results of the study make it possible to obtain the desired accuracy and speed of recurrent logarithmic ADCs in a given dynamic range. The results can be used in the design of systems and means of automation, telecommunications, information and measurement technology and the like.

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REMOTE MONITORING AND CONTROL SYSTEM OF ROOM CLIMATE PARAMETERS IN THE PROCESS OF INDUSTRIAL PRODUCTION

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Research methodology. The methodology based on a comparative analysis of existing systems and the development of an algorithm and system for remote monitoring and control of a technological process using IoT technologies.

Results. The proposed and developed system, hardware, and software, which allow safe, high-speed processing and storage of information, control and adjust the technological process automatically or with the operator cooperation.

Innovation. The innovation of this work lies in the combination of the operation of multiple data transfer protocols. The developed system has a high level of information security and ensures a decrease in energy consumption and an increase in performance.

Practical value. The research results showed that the developed system is economically profitable, it allows automating many technological processes. Currently, system is integrated into production and is operated at an enterprise for the production of semi-finished products and bakery products.

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USING NEURAL NETWORKS FOR DEVELOPING A SYSTEM TO AVOID ROAD OBSTACLES

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The article presents the use of a neural network for the implementation of a system for avoiding obstacle on the road. Considered algorithms, on the basis of which such a system can operate, and the principles of neural network training. For the interference avoidance system was used reward training system, since in road conditions it is impossible to create a table of input data and their corresponding outputs. The analysis of road situation is dynamic, so the neural network must learn directly in the environment where it will work. To implement the neural network, the Unity ML Agents plugin is used, which is a bridge between the program written in C # in Unity and the “brains” of the neural network, written in Python.

A simulator of a car and a road with obstacles has been developed to demonstrate the capabilities of the neural network in practice, as well as to conveniently and quickly collect data on its various configurations. For the most realistic behavior, the car model is built on the basis of Unity Vehicle Physics. The learning environment is a simple, straight line with obstacles scattered across it. The section does not have any distortions or turns, since the main task of the studied neural network is to avoid obstacles on the road, and not to react to turns. In one part of the straight there is a car. At each restart, the starting point

from which the car starts is chosen randomly, which adds variability to the test data and prevents the network from learning a “single” route. A search algorithm with division into subsectors was used to collect information about obstacles. This algorithm selects the nearest obstacles within the sector and ignores the distant obstacles. This allows you to reduce the amount of input data for the neural network and improve the response to a car moving past an obstacle.

As a result of the study, the main trends in the training of the neural network were identified. The training efficiency was determined by the amount of collisions during a fixed period of time during training. It has been experimentally established that the neural network is stable and generates similar results with different runs. It was found that changes in the wine-city system had little effect on stability, and all the negative effects of incorrect wine-building were repeated at each run with the appropriate configurations.

The proposed system can be used as a basis for the development of a full-scale obstacle avoidance system on the road, it will work as part of a car’s autopilot.

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REALIZATION OF AN AUTOMATED ACCIDENT ALERT SYSTEM

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Research methodology. The analysis of existing methods and means of construction of automobile accident warning systems is carried out. Based on the comparative analysis, the need to provide support for such regions in many regions of the world has been determined. The basic characteristics of existing systems are considered and determined by the correct choice of technologies that will ensure their efficient functioning.

Results. The scope of such systems is limited by data transmission technology, which requires low power consumption. Therefore, Bluetooth Low Energy (BLE) has been identified as the main communication technology between the car and the driver’s mobile phone. The OS Android is chosen to work with BLE devices. The car system that sends an accident alert signal is implemented on a microcontroller PSoC 4.

Novelty. The scientific novelty of the obtained results lies in the possibility of implementing the developed system in cars of different manufacturers. The ability to choose the region of the support service was identified as the main advantage in implementing such a system.

Practical meaning. The main area of application of the automated accident alert system in cars equipped with accident recognition systems that work based on Bluetooth Low Energy (BLE) technology. A software application for mobile devices based on the Android OS has been created. Modeling of the system based on the microcontroller is offered that allows providing simplicity of implementation and efficiency of its work.

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SYSTEM FOR DETECTING AND CLEANING PREMISES FROM HARMFUL GASES BASED ON INTERNET THINGS TECHNOLOGY

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The article deals with the development of an automated system for the detection and cleaning of premises from harmful gases. The device is implemented on the basis of the Arduino Uno microcontroller,

which collects, analyzes and processes the readings of methane, carbon dioxide and carbon monoxide content sensors in the air. The controller is configured for automatic data processing, in the event of a danger to human health, a corresponding message is generated and the air purification system is turned on. The device control program is written using the C++ programming language.

The ThingSpeak IoT platform was used to store and display the received sensor impressions. Data from the microcontroller to the ThingSpeak cloud platform is sent using a Wi-Fi module. The main component of the ThingSpeak data model is the channel. To write data to the ThingSpeak channel, a software implementation of the device's algorithm sends requests to the ThingSpeak server, initiating an HTTP request call. The developed software for the iOS mobile application is written in the Swift programming language. It allows you to read and display sensor readings from the ThingSpeak IoT platform, build a graph of any gas and its content in the air, and control the fan using the TalkBack command queue.

During the development of the system, special attention was paid to the following aspects: ease of operation, small size and weight, a wide range of measured gases, remote monitoring. Developed software for the Arduino Uno platform, subject to the relevant limitations of the physical platform, can run successfully on all similar Arduino platforms.

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DEVELOPMENT OF MULTIMEDIA SYSTEM WITH ELEMENTS OF PLAYING TASKS

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To develop a multimedia system using elements of gamification in teaching, the meaning of the concept of "gamification" is studied and the main elements used for gamification in the educational process are identified. The developed software solution for learning a foreign language with elements of gamification will improve the learning process, in particular, for school-age children.

The selection of the main elements of gameplay, which should be used in the development of educational programs for school-age children, has been studied. The problem structuring method was used to set goals. During the development of the project, a prototype of the future program was developed by means of Figma and the database was used to authorize users.

When creating the implementation of the software solution, separate classes were used for the pages – authorization, home page, learning new words, testing, as well as a mini-game "What is hidden in the box?". The software solution was implemented using the Qt Creator 4.11.1 (Community) software environment.

The obtained results show that the project of the educational system for learning a foreign language should be used for school-age children. When using the developed system, the number of actions of users is optimized.

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ESTABLISHMENT OF A FACING RECOGNITION SYSTEM FOR VIDEO OBSERVATION

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Research Methodology. Are analyzed and researched the intelligent video analytics methods, which takes place according to two main technologies – tracking and identification. On the basis of the rules laid down in the algorithm of video analysis forms all functionality of the information system which

is necessary for construction of video observation modern systems. Also are investigated of artificial intelligence systems, machine learning methods, cascade models of object recognition and neural networks. These results shows that it is best to use to create an information system for human face recognition the method based on advanced calibration networks. This method allows you to detect faces, which can be located both vertically and rotated at different angles, using a small number of steps.

Results. To face detect in the created system was calibrated the angle of rotation in the plane of each face of the candidate vertically into a three-stage multitasking network. The process of calibrating the exact angle of rotation in the plane is divided into three stages and approximately predicts the orientation at each stage. The principle of an image pyramid is applied to the input image to obtain and detect all available images of different sizes. Each face is transmitted through a detector in stages. After passing the entire image, the detector selects the faces of the candidates and creates a list of confidence levels for each test image. The result of the algorithm is the rejection of unregistered images and acceptance of registered ones.

Novelty. The scientific novelty of the obtained results is that the possibility of implementing researched algorithms of facing recognition with using neural networks in information systems of video observing. The productivity of the algorithm was confirmed by testing of created system.

The practical significance. We have projected the system architecture and have presented diagrams showing the results of the work. Developed system software, namely a database based on the SQLite database management system, server and desktop client on the Linux operating system and a mobile application, which allowed to explore the characteristics of the our information system.

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REVIEW OF ROBOTICS DEVELOPMENT. PART 1. (ROBOTICS TO THE XX CENTURY)

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Explorative methodology. The methodological basis of the research is represented by the principles of reliability and scientific objectivity, which are based on the priority of published materials. Comparisons and generalizations were used to highlight the state of the scientific methods developed on the topic to emphasize more significant features of robots.

Results. The review shows that the evolution of robotics took place until the twentieth century in accordance with the level of science and technology: at first robots were "purely" mechanical, then they were created by using electronics and microprocessors and last - with artificial intelligence.

The scientific novelty of the work lies in the systematization of a large amount of material on robotics and the development of robot classification.

Practical meaning. The results of the research make it possible to evaluate the properties of different classes of robots and can be used in training courses on the basics of robotics, automation, telemechanic and other similar disciplines.

DEVELOPMENT OF THE SYSTEM IS FOR THE SELECTION OF FILMS WITH THE USE OF CLIENT-SERVER ARCHITECTURE

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The system for searching movies based on their parameters has been developed. C # 7 programming language based on WPF framework and Json, LinQ, .NET and XAML technology is used. Shell and quick sorting algorithms and binary search are used to speed up information processing. Using the developed system will save time when selecting films according to certain criteria.

The algorithms of sorting and searching of information for acceleration of processing of records of a database of films are investigated and the original software decision is developed. The task is implemented in the C # 7 programming language based on the WPF framework. Json, LinQ, .NET and XAML technologies are used in the work. Fast sorting, Shell sorting and binary search algorithms are used to speed up information processing.

The results show that the developed system works efficiently and reliably. The system provides a minimum number of steps to perform actions with the user interface.

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DEVELOPMENT OF DOMESTIC SYSTEM OF SAFETY BASED ON INTERNET THINGS TECHNOLOGY

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Advances in smartphones and affordable public cloud servers have enabled the development of low-cost IoT-enabled home automation and security architectures.

This article proposes a home security system, the main task of which is to alert authorized persons about unauthorized access to premises based on IoT with a public cloud server CloudMQTT and an application for mobile phones. The paper discusses the functions of the security system and its applications.

The security system uses the Arduino Uno microcontroller, the interface between sensors for monitoring the status of the ISM band (915 MHz and 2.450 GHz) and the microcontroller is the NRF24L01 radio module, which is capable of combining up to seven sensors into a common radio network according to the star topology, in turn, allows you to solve technical problems in collecting data from several sensors at the same time. When an alarm occurs, the microcontroller connects to the Internet using a Wifi wireless connection using the ESP8266 module, the data from which is sent to the CloudMQTT cloud server. The system successfully connects to the CloudMQTT server using the authentication token and the CloudMQTT libraries. As a result, authorized persons will be able to receive the message on smartphones as soon as any status change has occurred. In addition, if for some reason there is no way to unite in the Internet, an additional branch of the structure is triggered, namely the block of the mobile network. With this block, one-way interaction between the microcontroller part of the system and the user interface is possible. This sequence is provided as an additional way of notifying the user in the form of an SMS message, increasing the ability to prevent unauthorized access. This feature becomes available when the GSM module SIM800L is connected.

So, this article provides an architecture that can be used as a basis for building low-cost, intelligent home security systems, as well as industrial and commercial applications where security and measures are paramount.

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USING AUTOMATIC SEGMENTATION USING THE HARMONIOUS FIELD TO RECOGNIZE THE IMAGE OF TEETH IN THE JAW

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Research methodology. An important preliminary procedure in automated orthodontics is the precise segmentation of the teeth from the 3D model of the jaw, which should include as few manual operations as possible. But the fully automatic separation of all teeth is not a trivial task, because the teeth are of different shapes and their location varies significantly from one to another. The difficulty is exacerbated when there are problems with occlusion and clumping of teeth, which is common in clinical cases.

Novelty. Most published methods in this area are either inaccurate or require many numerous manual interactions. Motivated by ultramodern general methods of mesh segmentation, which have adopted the theory of harmonic field to identify segments, this article researches a new, aimed at the dentistry structure of dental mesh segmentation. Thanks to a specially designed weighing scheme and a prior knowledge strategy for managing harmonic constraints, this method can effectively determine the boundaries of the teeth.

Results. In this work, the problem of the automatic segmentation of teeth in models of the jaw was researched. The use of an automatic tooth recognition algorithm on a 3D model of the jaw using a harmonic field allows solving this problem.

Practical Significance. For the practical application of this algorithm, the weighting factors proposed in this paper should be applied. To test the performance of these weighting factors, a program was developed that can be used to recognize tooth images from a 3D model of the jaw. A test of this program showed that the algorithm underlying it is valid.