

**ALWAYS IN TOUCH
WITH THE FUTURE!**

Ministry of Digital Development, Communications and Mass Media of the Russian Federation
**FEDERAL STATE BUDGET-FINANCED EDUCATIONAL INSTITUTION
OF HIGHER EDUCATION THE BONCH-BRUEVICH SAINT
PETERSBURG STATE UNIVERSITY OF TELECOMMUNICATIONS**

SPbSUT)))



CATALOG OF DEVELOPMENTS

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Ruslan Valentinovich Kirichek

Rector of SPbSUT, Doctor of Technical Sciences, Professor, Member of the Public Chamber of Saint Petersburg, President of the Saint Petersburg Drone Racing Federation, Honored Scientist of Saint Petersburg, Professor of the Department of Software Engineering and Computing.

The presented catalog of SPbSUT developments reflects the results of research and project activities by our staff and students. These are practice-oriented technologies, software products, engineering solutions, and scientific prototypes ready for implementation in educational, industrial, and high-tech environments.

We are confident that the university's developments can serve as the foundation for new products, services, and partnership projects. I hope the catalog materials will help you find the solutions you're interested in and discover new directions.

Mission of the SPbSUT

Training of specialists with higher education and highly qualified scientific personnel capable of perceiving, generating and implementing innovative ideas, creating competitive high-tech products in the field of communications, telecommunications, informatics and electronics.

Positioning Principles:

1. SPbSUT is developing as a leading higher education institution training specialists with systems thinking for the digital economy. The educational process combines fundamental scientific research with project activities, ensuring the training of personnel capable of developing and implementing innovative solutions in the field of communications, telecommunications, informatics and electronics.
2. The corporate culture of SPbSUT is based on the principles of collective work and interaction between students, faculties and researchers. This contributes to the development of teamwork and responsibility skills, as well as leadership qualities among students.
3. SPbSUT offers students a rich extracurricular life, including participation in scientific conferences, cultural and sports events, volunteer projects and student self-government. Such activity contributes to the comprehensive development of the individual and the formation of an active civic position.

HoloLink

HoloLink — holographic telepresence platform and terminals



Kucheryavy A. E.

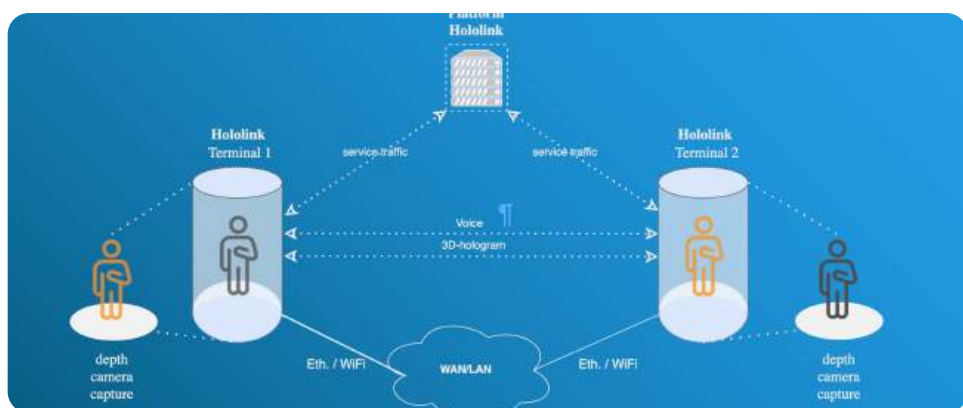


Исследования сетевых технологий
с ультра малой задержкой и сверхвысокой
плотностью на основе широкого применения
искусственного интеллекта для сетей 6G

The HoloLink platform is a conferencing system using user holograms. The platform implements the technology of transmitting 3D images of users as a «point cloud», which makes it possible to provide holographic-type communication services in existing networks.



HoloLink terminals based on volumetric technology are affordable, adapted to the HoloLink software. They support the new point-cloud technology as well as the group video stream technology.



Scenarios and areas of application



Conference Communication: Platform software (available as a white-box or SaaS service) with multi-platform support for user terminals (Hololink holographic terminals, augmented reality application (headset and smartphone), PC).

Holographic University/School: Educational process with a high level of immersion, based on delivering courses in the form of 3D holograms and enabling interactive interaction, including with a remote teacher appearing as a hologram.



Current Stage: MVP

1. Three types of terminals (hardware) have been developed. The technology for their production has been created. A Russian Federation utility model patent has been obtained.
2. The Hololink Platform software has been developed, enabling communication between multiple terminals over the Internet. Object transmission is based on point-cloud technology.
3. A pilot project «Holographic University» is being implemented at The Bonch-Bruевич Saint-Petersburg State University of Telecommunications:
 - 12 desktop personal terminals (for playback of 3D educational course content),
 - one full-height terminal for the hologram-avatar of a remote teacher.

TELE- PRESENCE SUIT

Kucheryavy A. E.



Исследования сетевых технологий
с ультра малой задержкой и сверхвысокой
плотностью на основе широкого применения
искусственного интеллекта для сетей 6G



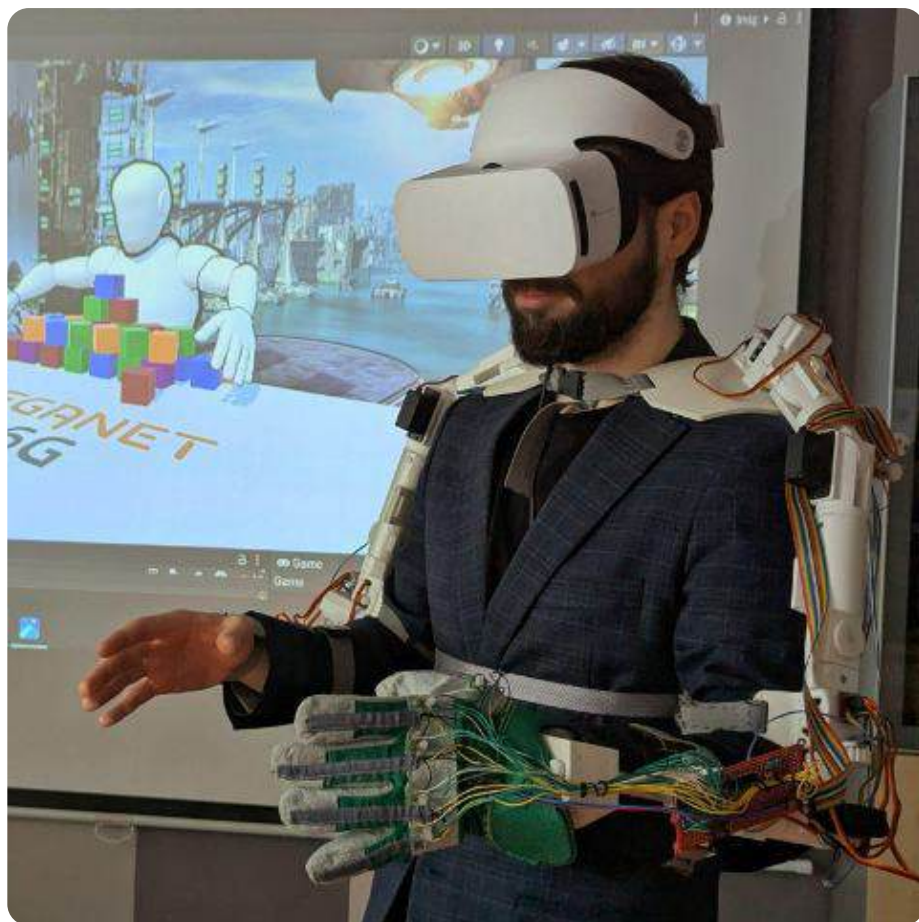
At the MEGANETLAB 6G research laboratory of SPbSUT, a telepresence suit with kinesthetic feedback and a Metaverse prototype were developed to study the problems of interaction between the digital and physical worlds.

Features

- Force feedback
- Reading of user movements (all degrees of freedom of the upper limbs)
- Transmission of sensations of heat and cold
- First-person view (XR, VR)
- User movement analysis algorithms
- Avatar based on «digital twin» technology
- Recording of user movements (with the possibility of subsequent analysis for correction of digital skills)
- Ability to interact with the Metaverse



Video
presentation



Unmanned aerial system identification system

Dyubov A. S.

Berezkin A. A.

R&D Institute «Communication Technologies»

Purpose

The identification system allows for real-time detection and tracking of unmanned aerial systems, also integrated with external flight monitoring and management services.



System composition

The system consists of a server part and trackers — miniature modules installed on drones that transmit a unique identifier via mobile network infrastructure. Digital Object Architecture (DOA) is used for identification.

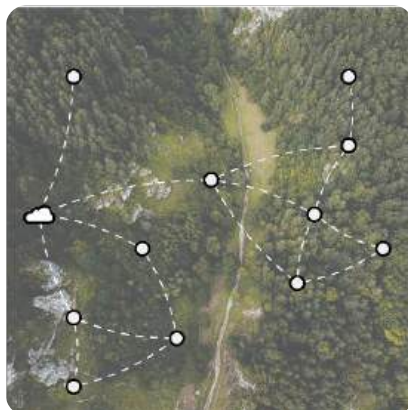
Technical specifications

- Built-in LTE/GSM module
- Radio interface: GSM/GPRS/EDGE 900/1800 MHz
- GNSS receiver: GPS/GLONASS/Galileo/QZSS
- Weight: no more than 75 g
- Operating temperature range: -40 °C to +80 °C

Protocol for wireless synchronous mesh IoT networks

Dyubov A. S.

R&D Institute «Communication Technologies»



Purpose

The protocol provides the basis for building reliable wireless synchronous mesh networks with large coverage areas and high energy efficiency. The protocol plays an important role in organizing efficient and scalable communication between multiple devices. A large coverage area (significant communication range) is achieved through mesh topology. In such networks, every device is a network node, and only one network coordinator is sufficient for management and routing.

On-board identification device for unmanned aerial systems based on digital object architecture

Dyubov A. S.

R&D Institute «Communication Technologies»



Purpose

The on-board identification device (OID) is a part of the identification and traceability system for unmanned aerial systems (UAS) based on Digital Object Architecture. The OID is an electronic device with a unique identifier containing a microcontroller, cellular modem, sensors (barometer, accelerometer, gyroscope), and autonomous power supply. Installed on UAS, it registers and transmits flight coordinates and characteristics.

Technical specifications

- Built-in LTE/GSM module
- Radio interface: GSM/GPRS/EDGE 900/1800 MHz
- GNSS receiver: GPS/GLONASS/Galileo/QZSS (33 tracking channels)
- Weight: no more than 75 g
- Operating temperature range: -40°C to $+80^{\circ}\text{C}$
- Autonomous operating time: up to 8 hours

Video codec test bench for FPV control of unmanned aerial systems via satellite communication channels

Berezkin A. A.

R&D Institute «Communication Technologies»



Purpose

The video codec test bench is designed for comprehensive evaluation of video stream transmission from an unmanned aerial vehicle (UAV) to the external pilot station in FPV (First Person View) mode via satellite communication channels.

The system allows studying the influence of video codec parameters and channel characteristics on image quality and transmission delays.

The test bench is intended for developers of video surveillance systems, UAV operators and telecommunications specialists.

Technical specifications

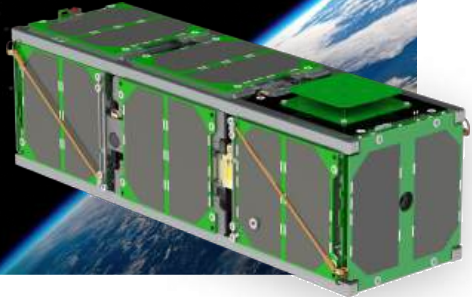
- Flexible architecture: includes video stream generator (IP camera APIX 22ZBox/M8), PC encoder supporting standard and neural network codecs, PC decoder and analysis tools.
- Powerful hardware base: two PCs with Linux Mint 22.1 x86_64, AMD Ryzen 7 5700G processor and NVIDIA GeForce RTX 4080 SUPER graphics card for high-performance video processing. Use of a non-programmable switch for stable connection.

SIT-HSE

SPbSUT CubeSat for testing
IoT technology



Satellite
observation



A small spacecraft designed to test Internet of Things technology based on the LoRa protocol and for Earth imaging. Students of the Saint Petersburg State University of Telecommunications will participate in experiments and analyze the results.

IoT technology opens new opportunities worldwide and is important for applications in housing and utilities, transport, agriculture, industry, and most importantly — communication with remote territories.



The small spacecraft is built on the SPUTNIKS 3U
CubeSat satellite platform.

Technical specifications

- Spacecraft name: SIT-HSE
- NORAD ID: 61763
- Callsign: RC2336
- Frequencies: 401–402 MHz, 8175–8215 MHz
- Size: 3U
- Weight: 3.2 kg
- Payload: IoT, camera
- Purpose: IoT, Earth observation
- Platform: SPUTNIKS LLC
- Launch: November 5, 2024, Vostochny Cosmodrome (NSSDC ID: 2024-199)
- Orbit: Sun-synchronous, inclination 97.38°
- Launch vehicle: Soyuz-2.1b with Fregat upper stage

Hardware-software complex for analog video signal and control commands transmission over fiber-optic cable with minimal latency

Shelepov M. Yu.

Purpose

The device is designed for transmission of analog video signal and control signals over a fiber-optic communication channel with minimal latency.

Contains two optical transceivers, an FPGA for multiplexing the digitized video signal with a UART signal, an ADC/DAC IC, and an RS-485 interface driver IC.

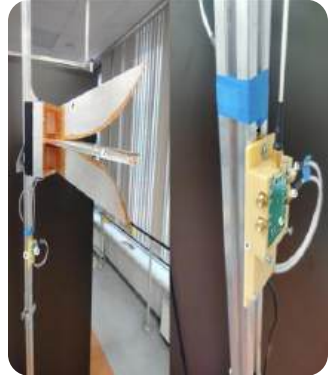


Technical specifications

- Design: two single-board transceivers
- Power supply: 5 V DC
- Power consumption: no more than 5 W
- Weight: no more than 0.25 kg
- Operating temperature range: -40°C to $+55^{\circ}\text{C}$
- Service life: at least 10 years
- Mean time between failures: 25,000 hours

Spherical scanning stand for measuring a wide range of antenna characteristics

Kuzmin S.V.



Purpose

The hardware–software tools of the stand allow obtaining the volumetric radiation pattern, antenna polarization characteristics, polarization radiation pattern over a wide frequency range. The stand is a visual aid for working with complex systems and is used in laboratory and research work.

Technical specifications

- The applied motor provides positioning accuracy in azimuth and tilt of no worse than 0.5 degrees
- Frequency range: 1–8800 MHz
- Variable IF bandwidth: 20 Hz – 1 kHz
- Dynamic range of transmission coefficient measurements: more than 80 dB
- Scanning speed: 500 points/s

Adaptive 8-element antenna array

Glushankov E. I.

Korovin K. O.

Boyko I. A.



Purpose

The device is intended to organize mobile communication as base station antennas, hybrid communication as terrestrial station antennas, and communication with UAVs.

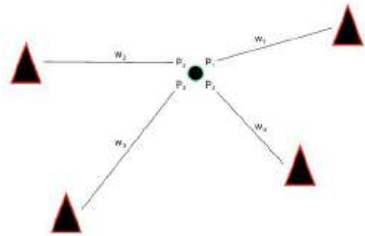
Technical specifications

- Design: single-board
- Power supply: 12 V for RF amplifiers, 220 V for the board
- Delivery set includes converter: 220 V AC / 24 V DC
- Power consumption: no more than 5 W
- Weight: no more than 5 kg
- Operating temperature range: $-20...+40$ °C
- Service life: at least 5 years
- Mean time between failures: 25,000 hours

SDR demonstrator of LTE signal analyzer

Fokin G. A.

Tsap V. V.



Purpose

The signal analyzer is designed to determine the location of a user device that is not a subscriber of the network by analyzing broadcast signals of LTE standard base stations.

Technical specifications

- Transceiver: AD9361
- Frequency range: 70 MHz – 6 GHz
- Number of channels: 2TX / 2RX
- Bandwidth: up to 56 MHz
- Power supply: 5 V DC

The device is designed to determine the location of a user device that is not a subscriber of the network by analyzing broadcast signals of LTE standard base stations. It contains a LibreSDR receiver and PC with MATLAB software.

Wi-Fi signal analyzer based on software-defined radio

Fokin G. A.

Meshcheryakov D. E.

Bagaev E. S.



Purpose

The prototype is designed to detect Wi-Fi access points and analyze service frames to determine MAC address, channel width used by the device and equipment manufacturer in the 2.4 and 5 GHz bands of different generations of devices.

Contains a software-defined radio device, personal computer (laptop) with installed MATLAB software.

Technical specifications

- Number of channels: 2 TX, 2 RX
- DAC/ADC resolution: 12 bits
- TX carrier frequencies: 325 MHz to 6 GHz
- RX carrier frequencies: 325 MHz to 6 GHz
- Support for TDD and FDD duplex
- Bandwidth: 200 kHz to 56 MHz

SDR DEMONSTRATOR OF RADIO LINK MANAGEMENT USING XAPP IN SRSRAN

Fokin G. A.

Dyudin A. I.

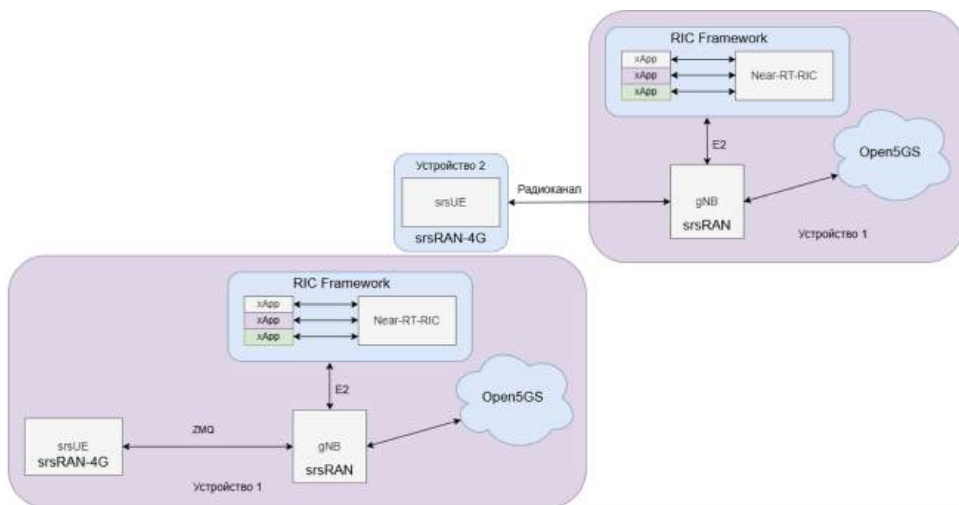
Purpose

Demonstration of the possibility of using third-party radio network management applications (xApp) in intelligent radio network controllers (RIC) within the Open RAN concept.

Technical specifications

- Decision-making time: from 10 ms to 1 s
- Ability to work completely virtually
- Ability to use DL/ML for radio resource allocation of base stations
- Control of multiple base stations
- Implementation of Near-RT-RIC as a network function

Test Bench Architecture



SDR demonstrator of MIMO system

Fokin G. A.

Sheremet N. V.



Purpose

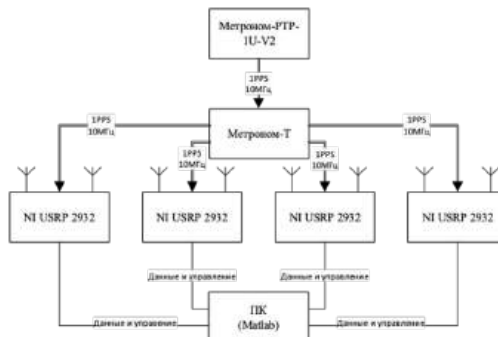
The demonstrator is designed for studying, prototyping and evaluating MIMO algorithms, positioning and beamforming of antenna array patterns.

Equipment: Metronom-PTP-1U-V2 (1PPS, 10MHz), Metronom-T (1PPS, 10MHz), NI USRP 2932 (4 units, each with 1PPS, 10MHz).

Technical specifications

- Frequency range: 400 MHz – 4.4 GHz
- Bandwidth: 20 MHz
- Duplex: full
- Number of transmit antennas: 4
- Number of receive antennas: 4
- Synchronization method: 1PPS and 10 MHz signals

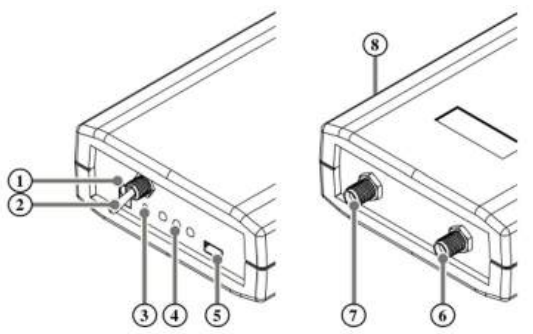
Demonstrator Schematic



Automated complex for monitoring 2G-4G cellular communication systems

Antipin B. M.

R&D Institute «Communication Technologies»



1. Connector for external power supply.
2. Hardware module power switch.
3. Hidden hardware reset button.
4. Indicator LEDs:
 - green — device is on and ready;
 - yellow — external power connector is connected;
 - red — battery charging in progress.

5. Mini USB cable connection connector.
6. Main antenna connection connector.
7. Additional antenna connection connector.
8. Switch physically disconnecting the battery (for long-term storage or air transportation)

Purpose

The cellular network monitoring complex is designed for scanning and analyzing base stations and cellular network nodes within the accessibility zone. The collected information can be presented as tables or reports and displayed on a map.

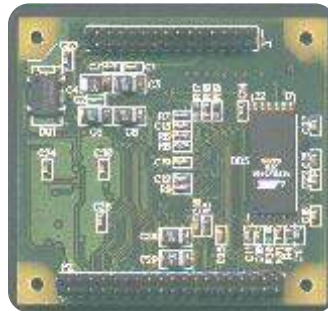
Technical specifications

- Design: single-board
- Power supply: 12 V DC
- Delivery set includes converter: 220 V AC / 12 V DC
- Power consumption: no more than 5 W
- Weight: no more than 0.25 kg (without PC)
- Operating temperature range: 0 °C to +40 °C

Noise suppressor

Babkin V.V.

R&D Institute «Communication Technologies»



Purpose

Speech cleaning from quasi-stationary acoustic noise (transport, street, office) is performed using a digital adaptive filtering algorithm in the frequency domain. The algorithm is implemented as a noise reduction device (NRD) intended for use in communication equipment operated under high ambient acoustic noise conditions. For example, one version of the NRD is used in piloted cosmonautics.

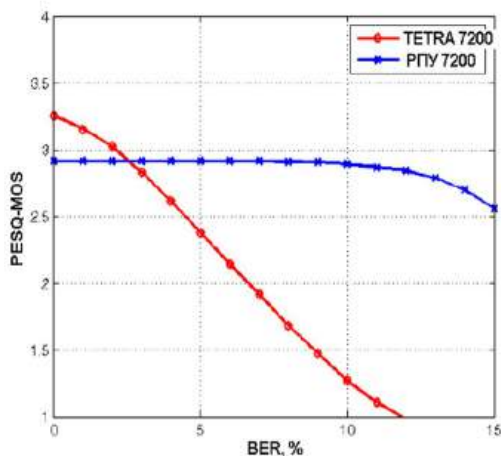
Contents of the NRD

Central digital signal processor with performance up to 100 MIPS, RAM, ROM and I/O interfaces (ADC/DAC) for connecting a headset (microphone and headphones or symmetric interface for transition to analog communication lines).

Technical specifications

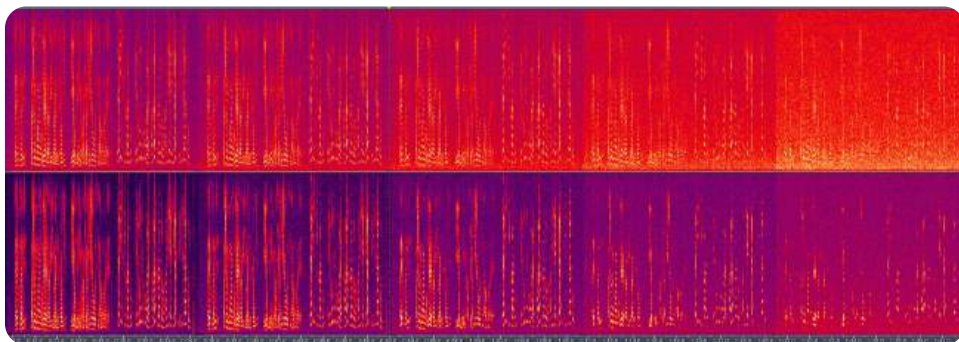
- Design: mezzanine on the customer's board
- Power supply: 3.3 V DC
- Operating temperature range: $-40...+80$ °C

Comparison of RPU and TETRA 7200 bit/s



The interference-resistant vocoder maintains acceptable speech quality up to 10–15% bit errors in the channel, while the TETRA system only up to 3–4%.

Example of NRD operation at different SNR



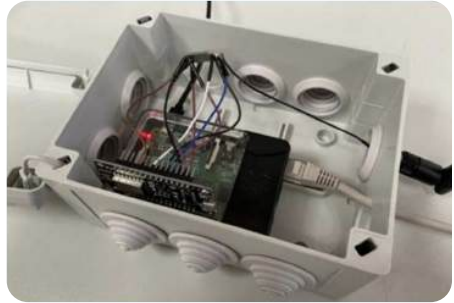
Input signal-to-noise ratio (SNR) varies from 24 to 0 dB.
Noise type — pink.
The frequency band from 0 to 4 kHz is shown.

Specialized agent for self-organizing network for collecting meteorological data in mountainous terrain based on LoRa technology

Pupcev R. I.

Nekrasov S. G.

Babich V. N.

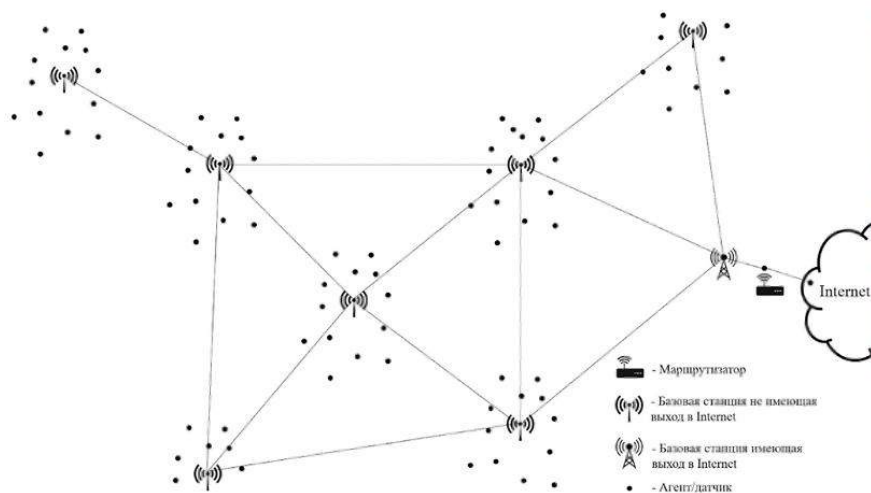


Purpose

The device is designed for autonomous collection of meteorological data in Arctic weather conditions and transmission of collected and relayed information. Contains a number of sensors, transceiver and computing module. The number and type of sensors may differ from the agent version.

Technical specifications

- Design: single-board
- Power supply: from battery, 3.7 V
- Operating range without relaying: up to 1.5 km
- Weight: no more than 0.25 kg
- Message transmission parameters: RSSI up to -110 dBm, SNR up to -12 dB
- Transmission frequency: 868.8 MHz
- Operating temperature range: -40 °C to +40 °C



1. Conducting tests in Arctic conditions
2. Second Arctic expedition to Spitsbergen
3. Testing the prototype before trials in mountains

NB-PLC modem for data transmission over power grids

Kopylov D. A.

R&D Institute «Communication Technologies»



Purpose

The NB-PLC modem is designed for low-speed data transmission over low and medium voltage electrical networks as part of systems for electricity metering, security and fire alarm systems, object state monitoring, etc.

Contains a modem operating over power transmission lines and I/O interfaces for data from sensors located at the controlled object.

Technical specifications

- Frequency bands: Cenelec A (34–90 kHz), Cenelec B/C (95–140 kHz), FCC (150–490 kHz) and FULL (34–490 kHz)
- Standards: G3-PLC, IEEE 1901.2
- Interfaces: RS-232, RS-485, Ethernet/IPv4, mini-USB
- Protocols: MODBUS, IEC-870-5-101, IEC-870-5-104
- Number of modems in the network: up to 1000 pcs.
- Connection to the power grid: capacitive or inductive
- Power supply: 24...30 V DC
- Power consumption: no more than 3.5 W

Virtual laboratory complex based on a Mach-Zehnder interferometer for studying quantum phenomena

Bylina M. S.

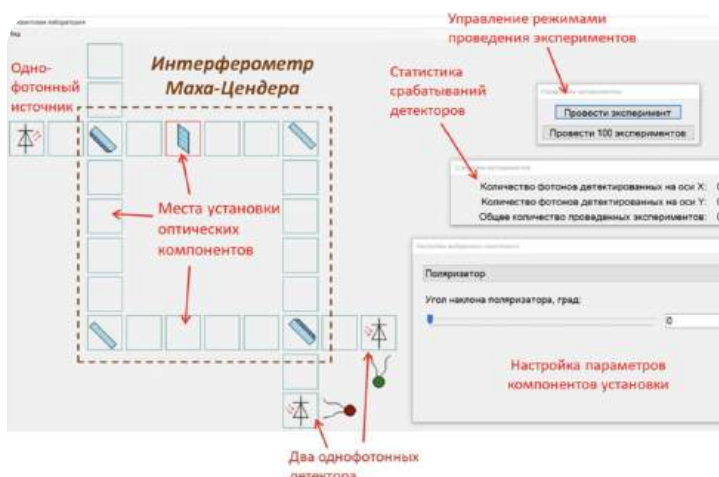
Brazovsky G. R.

Purpose

The virtual laboratory complex is designed for training within disciplines related to the study of the fundamentals of quantum mechanics and quantum technologies.

The virtual laboratory complex simulates the operation of:

- a Mach-Zehnder interferometer (MZI) consisting of two semi-transparent and two opaque mirrors;
- a source supporting two radiation generation modes — continuous radiation and emission of single photons, allowing to set polarization and wavelength;
- two photodetectors capable of receiving either continuous radiation or single photons;
- passive optical components (phase shifters, filters, polarizers, Faraday cells) that can be included in various combinations at the source output, in the MZI arms, and at the photodetector inputs, as well as configure their parameters.

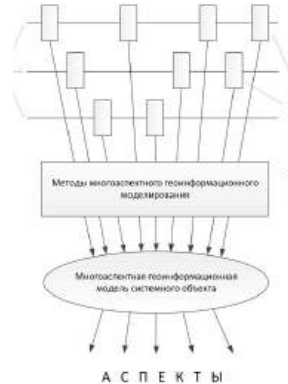
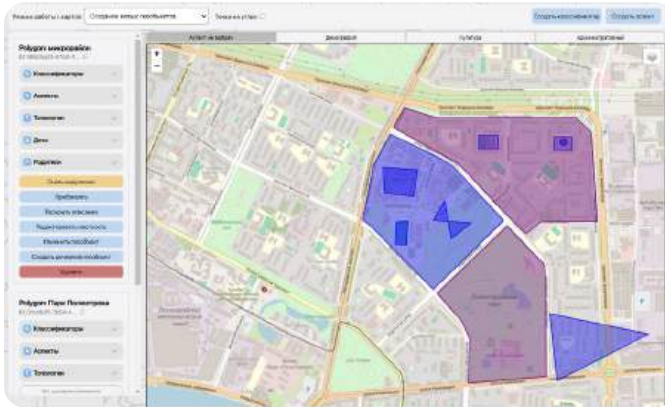


Prototype of a multi-aspect geoinformation modeling system

Verkhova G. A.

Akimov S. V.

Demyanik A. V.



Purpose

The prototype is intended for research in the field of multi-aspect geoinformation modeling and creation of digital twins of natural-technogenic geosystems.

Technical specifications

- Technologies: ASP.NET Web API, GeoJSON, Entity Framework Core, React
- Methods: multi-aspect modeling methodology, Domain Driven Design
- Programming language: C#
- GIS platform: Leaflet, OpenStreetMap

Stand for studying industrial automation devices based on PLC

Verkhova G. A.

Akimov S. V.

Demyanik A. V.



Purpose

The stand is designed for laboratory and practical classes related to the study of industrial automation instruments and devices.

Technical specifications

- Design: modular
- Power supply: 24 V DC
- Includes industrial computer, two touch displays, interface converter, various physical quantity sensors, hour counter, industrial timers

Software and hardware complex for rapid detection of abnormal situations using computer vision

Timchenko V. I.

Chernov I. N.

Himenkova D. A.

Fisechko N. S.



Purpose

An operational test bench for detecting pre-emergency situations (flames, smoke, short circuits in the electrical network, displacement of objects), enemy UAVs, etc. on a computer (machine) vision platform using artificial intelligence elements.

A working unit for analyzing pre-emergency situations has been developed and presented.

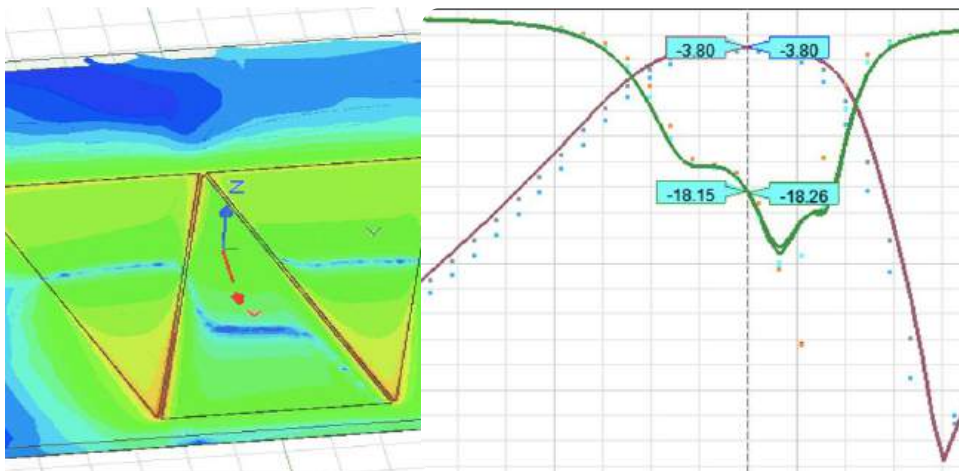
Technical specifications

- Type: Computer program (IBM-compatible PC)
- Language: Python 3.10+
- OS: Linux Ubuntu 20.04+
- Size: 6 GB
- Architecture: Web interface (FastAPI, WebSocket)

Filters on irregular lines

Sedyshev E. Yu.

Ivanisheva E. F.



Purpose

The microwave filter can be used in transceiver modules, communication systems, information storage and transmission systems.

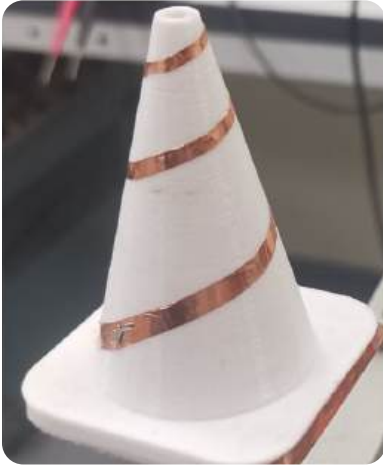
Technical specifications

- Planar design
- Principle of constructing elements on available area rather than calculating occupied space
- High steepness of the right slope of the amplitude-frequency characteristic

Conical spiral antenna on irregular line of Ku-band

Sedyshev E. Yu.

Fedorov S.I.



Purpose

The demonstrated element is supposed to be used in an antenna array for satellite communication.

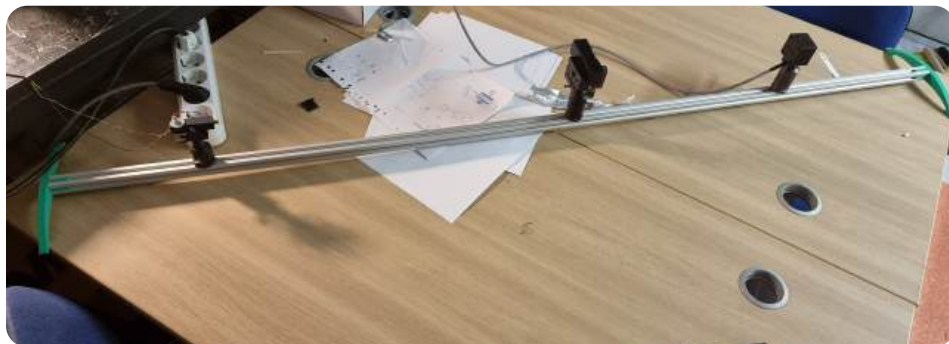
Technical specifications

- The demonstrated antenna array element was measured in the range of 8–18 GHz;
- in the specified frequency range, a single element had two operating bands around 12 and 15 GHz;
- the operating characteristics of the element showed serious dependence when changing the power supply method.

Acousto-optic light flux switch

Reznikov B. K.

Gryzulev S. S.



Purpose

This exhibit showcases the principle of acousto-optic modulation, light diffraction on an acoustic grating, and laser beam control capabilities. Applications include communication systems, laser spectroscopy, signal processing, and photonic technologies.

Technical specifications

Light Source:

- Type: Optical quantum generator (laser).
- Wavelength: 650 nm.
- Output power: 5 to 50 mW max.
- Mode of operation: Continuous wave (CW).

Acousto-Optic Modulator (AOM):

- Crystal material: Quartz.
- Center frequency: 40-80 MHz.
- Frequency bandwidth: ± 5 -10 MHz.
- Diffraction efficiency: up to 70-90%

Development of a multi-agent road traffic control system

Bondarenko I. B.

Pelikh D. A.

Zaborovskaya N. V.

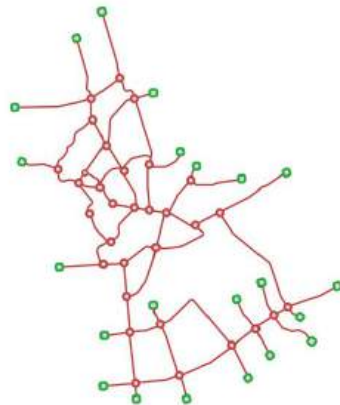
Gerasimov V. Yu.

Zharanov D. O.

Карта города



Имитационная модель



Purpose

The developed system is aimed at optimizing the duration of traffic light phases depending on the road network load in order to increase its capacity. Modern traffic control systems, as a rule, are aimed at rigidly setting the phase duration depending on the time period, which makes them non-adaptive to current road situations. This in turn significantly affects the number of traffic jams.

The system implementation includes combining simulation modeling to assess the road situation, analysis and processing of input data, agent-based decision-making approach and neural network technologies for coordination of agent actions.

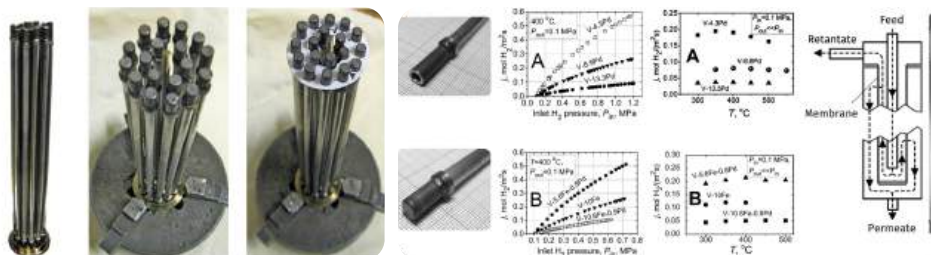
Technical specifications

Laptop with installed software: Windows 10, AnyLogic 7.8.

Palladium-free alloy membranes for ultra-pure hydrogen separation

Peredistov E. Yu.

Livshits A. I.



Purpose

For the first time in the world, membranes made of vanadium alloy suitable for practical applications have been created:

- thin-walled tubular membranes with micron palladium coating on the outer and inner sides, as well as hermetic welded transitions to stainless steel for ultra-pure hydrogen separation;
- assembly of such membranes;
- purity $U=99.99999U=99.99999$

Technical specifications

1. Tubular membranes: diameter 6 mm, wall thickness 120-200 μm , length up to 300 mm.
2. Operation in various hydrogen-containing gas mixtures with a total pressure on the inlet side of the membrane up to 12 bar, a partial pressure of hydrogen on the inlet of 6 bar, and a pressure of hydrogen on the outlet of 1 bar.
3. The density of the penetrating hydrogen flow is more than 0.5 $\text{cm}^3/\text{cm}^2\text{s}$.
4. The purity of hydrogen on the outlet of the membrane is 99.999999997%.

Laboratory bench for detecting radio bugs and stress-testing wireless data transmission systems

Shterenberg S. I.

Storozhuk N. L.

Budarny G. S.



Purpose

The laboratory bench includes a training software mock-up for radio interception and a hardware complex consisting of HackRF One + Portapack device. It is designed for testing and development of modern radio technologies and next-generation technologies.

Technical specifications

1. Raspberry, Arduino, VM Linux, laptop. The main layout is a traffic analyzer.
2. Interfaces:
 - two 10/100/1000 Mbps ports with RJ45 connectors; two 1000 Mbps ports with SFP sockets; one USB port for control from a personal computer; one 10/100 BASE-T port for remote control with an RJ45 connector; color graphic liquid crystal indicator with 320×240 pixels resolution, with adjustable backlight brightness that allows operation in bright sunlight; membrane keypad.
3. Physical specifications:
 - Weight: 0.6 kg;
 - Dimensions: 196 × 100 × 40 mm.
4. Power supply: via a network with a voltage of 220-230 V and a frequency of 50-60 Hz via a network adapter; from six AA batteries, the battery runtime is at least 6 hours; battery type NiMH; battery charging time is no more than 12 hours.

Omnidirectional sound source

Ishutina O.S.

Svin'ina O.A.



Purpose

Two-way omnidirectional sound source based on domestic loudspeaker drivers, designed for measuring acoustic parameters of premises in accordance with GOST R ISO 3382-1-2013 and GOST R 54579-2011 (ISO 18233:2006).

Areas of application

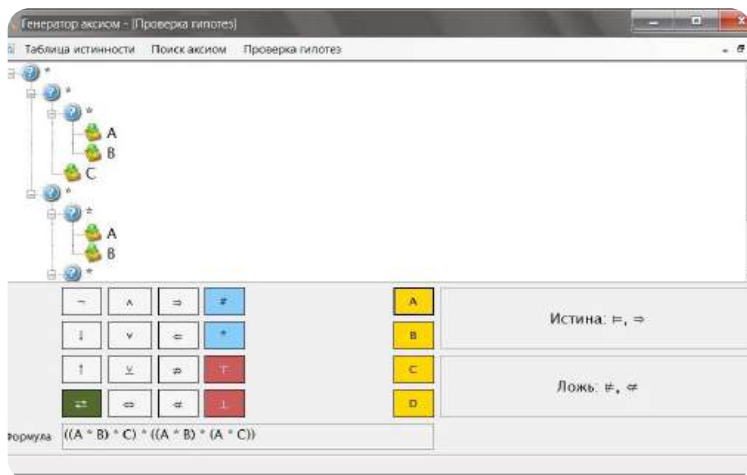
- Measurement of impulse response and room transmission coefficient
- Measurement of room reverberation time; early decay time; ratio of average energy of early and late responses; energy of early and late lateral responses;
- Study of sound field structure and room natural frequency spectrum;
- Study of properties and effectiveness of sound-absorbing materials and structures.

Technical specifications

- Sensitivity: 90 dB/W/m
- Effectively reproduced frequency range, Hz: 33–11360 Hz
- Frequency response unevenness: 10 dB

Propositional calculus axiom generator

Medvedev S. A.



Purpose

The axiom generator is a Windows-based software application designed to automate the discovery of propositional formulas that can be used to identify specific logical operations. The system supports both unary and binary operations. It offers multiple operational modes, including manual formula verification and automated criteria-based formula search.

This tool is suitable for research laboratories engaged in fundamental investigations within the domain of propositional logic.

Technical specifications

- Type: PC software (IBM-compatible)
- Language: C#
- OS: Windows XP+
- Size: 176,640 bytes

Development of an intelligent network intrusion detection system based on Suricata IDS/IPS and machine learning methods

Krivets A. S.

Shterenberg S. I.



Purpose

The proposed approach uses the eve.json event log as the source of network events and implements a hybrid risk assessment scheme that combines the results of signature-based detection, anomaly detection models, and attack classification models.

The developed system not only identifies events matching known signatures but also detects suspicious deviations in network behavior, thereby improving the information value of monitoring and reducing the analyst's workload.

Technical specifications

- Type: PC software (IBM-compatible)
- Language: Python 3.10+
- OS: Linux Ubuntu 20.04+
- Size: 6 GB
- Architecture: Web UI (FastAPI, WebSocket)

Radio communication network analyzer

Prasolov A. A.

Roshchinsky R. S.

Примеры существующих на рынке решений:



Purpose

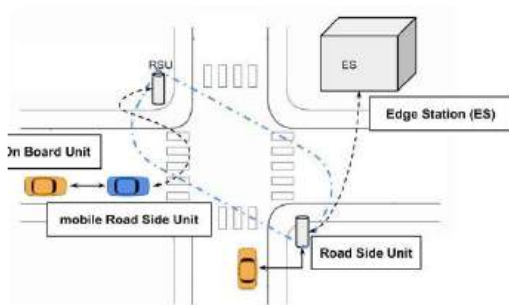
- Radio measurements and output of energy parameters (signal levels, signal-to-noise ratio); frequency channels of uplink and downlink, identifiers of the serving base station (BS);
- Output of parameters of detected neighbor BSs;
- Recording of measurement results to a log file;
- Visualization of log files with measurement results in the form of a coverage heat map;
- Viewing measurement results at each point of the route;
- Filtering of measurement results by communication standard, serving operator, measurement period.

«VANET 2.0» Software complex

Plotnikov P. V.

Vladyko A. G.

Tambovtsev G. I.



Purpose

Modeling of intelligent transport system processes based on Vehicle-to-Everything (V2X).

Features

Modeling of V2X interactions:

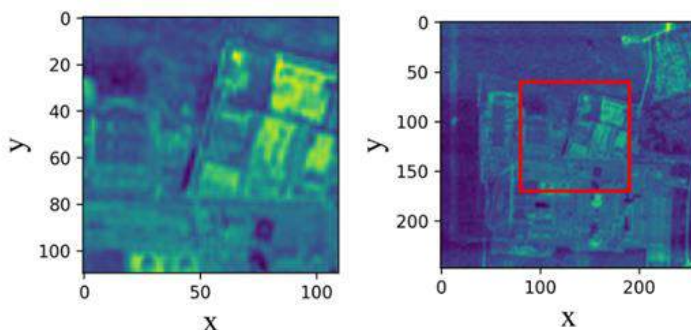
- reception/transmission of free-format messages (can be modified to comply with industry standards);
- integration of OSM map (location graph map);
- signal attenuation calculation (by default using 3GPP models, but can be modified);
- placement of roadside infrastructure objects (RSU, ES/MEC);
- dynamic route rebuilding, vehicle movement;
- use of mobile RSU (mRSU);
- calculation/visualization of RSU network load with subsequent load balancing capability;
- RSU clustering; information caching (on OBU, RSU, mRSU and ES/MEC);
- calculation of losses in the modeled system.

Computer vision system for autonomous vehicle navigation

Zikratov I. A.

Belyaev P. Yu.

Neverov E. A.

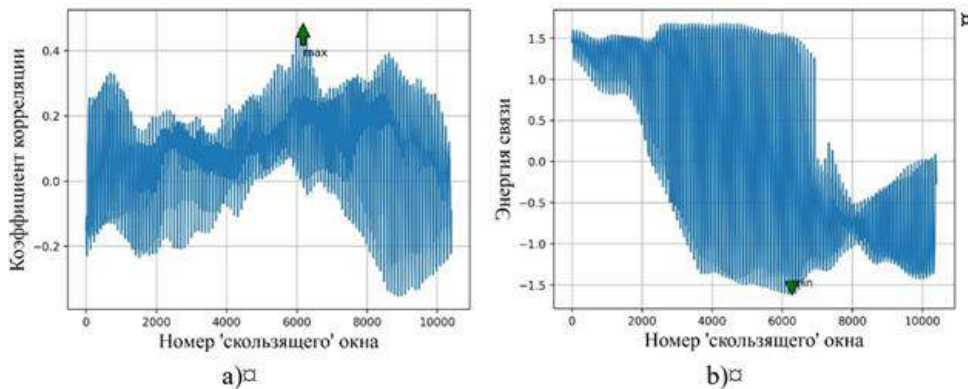


Purpose

Navigation using computer vision tools implemented by on-board optical and computing devices. Machine vision implemented by on-board computing devices ensures vehicle autonomy in the absence of an unstable satellite navigation system communication channel.

Technical specifications

- Interface type – console launch of a Python script.
- Platform – cross-platform software implementation.
- Operating system – Windows, Linux or macOS.
- Hardware architectures – x86, x86_64, ARM, ARM64, including single-board computers like Raspberry Pi and Jetson.
- Software used – Python environment with libraries for loading and processing images (NumPy, OpenCV).
- Input data is the current image from the UAV camera and the reference image of the terrain stored in the system memory.
- Output data is the coordinates of the found terrain section and the value of the residual (communication energy).



Results of the calculation of a) the correlation coefficient r and b) the correlation energy ω between the matrices of the «observed» and «reference» images as the «sliding» window moves.

- Mathematical basis: immunocomputing and singular value decomposition (SVD).
- Operating mode: autonomous, capable of operating without a stable communication channel or satellite navigation.
- Hardware: onboard camera, onboard computing device, storage device containing a reference map.
- Resource requirements: low computational demands compared to neural network methods.
- Limitations: visually distinguishable landmarks on the terrain are required, such as roads, buildings, rivers, and populated areas.

Applications

The system is designed for autonomous UAV navigation without GPS in the presence of interference or communication outages, provided visual patterns (roads, buildings) are available. Terrain types include forests, rural areas, and urban environments.

Applications include reconnaissance and monitoring (territorial surveillance), search and rescue operations (searching for people in areas without communication), agriculture (field monitoring), environmental monitoring (fire and forest monitoring), cartography and geodesy (map refinement and navigation without infrastructure).

The system is suitable for large, medium, small, and micro UAVs.

Operating conditions include the absence of GPS/GLONASS, weak or absent communication channels, and autonomous missions.

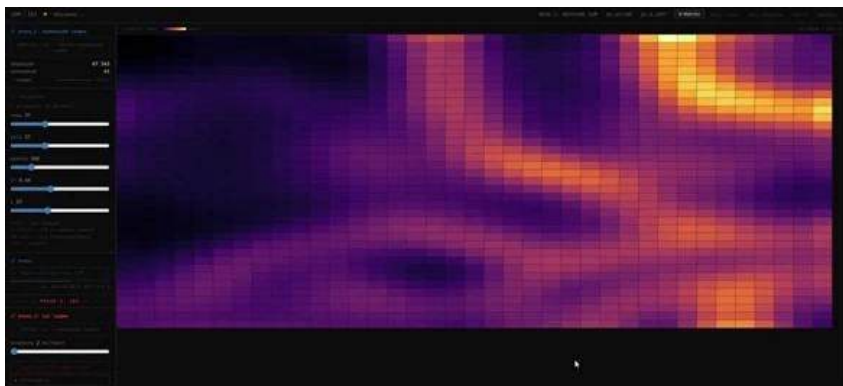
Network intrusion detection program based on a self-organizing Kohonen map

Zuev D. P.

Sharifov R. G.

Potemkina Yu. F.

Shterenberg S. I.



Purpose

The software performs two-phase network traffic analysis based on the NSL-KDD dataset. It is trained on normal traffic patterns and subsequently enables real-time anomaly detection, with all processes visualized via a web interface.

The mean absolute error (MAE) for correct location estimation achieved by the proposed method ranges from 0.109 to 0.153.

Technical specifications

- Type: PC software (IBM-compatible)
- Language: Python 3.10+
- OS: Windows 10+ / Linux Ubuntu 20.04+
- Size: 136 KB
- Architecture: Web UI (FastAPI, WebSocket)

«Smart clothing» with integrated flexible antennas for operation in the northern regions of Russia

Morozov A. A.

Purpose

The project is aimed at creating innovative smart clothing with integrated flexible antennas to ensure continuous monitoring of user biometric parameters, accurate positioning using the GLONASS system and stable data transmission in extreme conditions of the Arctic and northern regions of Russia.

Contains a jacket with integrated sensors and flexible antennas, mannequin, microcontroller.



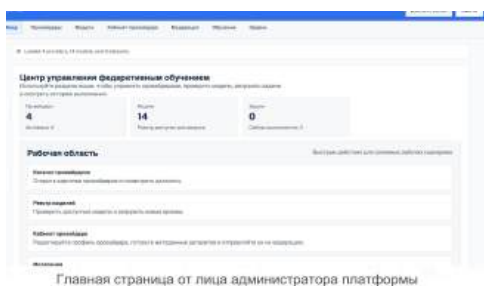
Technical specifications

- Stable communication range: in line-of-sight conditions: up to 10 km
- Power consumption: no more than 0.3 W
- Weight: no more than 3 kg
- Operating temperature range: -40°C to $+20^{\circ}\text{C}$
- Service life: at least 5 years
- Mean time between failures: 15,000 hours

A platform for confidential model training of customer models using data distributed across data holders

Penkin B. S.

Pomogalova A. V.



Главная страница от лица администратора платформы

Purpose

The proposed solution combines functions for training task management, orchestration of federated rounds, model artifact storage, and execution result logging. The project aims to create an architectural foundation for secure and controlled training of models on distributed confidential data.

Technical specifications

- The system is a distributed FL stack built on Java 21 (Spring Boot 3) and Python 3.11, deployed on Linux.
- The central server, React-based UI, and Orchestrator (powered by aiokafka) coordinate Python clients (Flower, PyTorch) via Kafka, MinIO, and PostgreSQL.
- Security is provided by Keycloak (OAuth2/OIDC).

AR-room of A.S. Popov

Musaeva T. V.

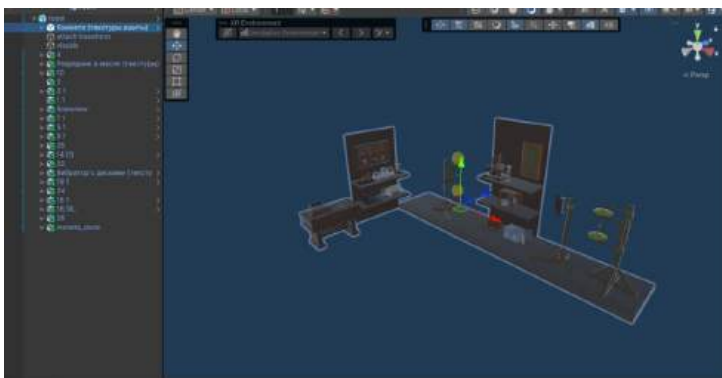
Boyashova E. P.

Goldin I.

Belyaev B. R.

Zherdetsky A. G.

Pigareva Y. R.



Purpose

At the request of the director of the A.S. Popov Central Museum of Communications, a project was undertaken to develop a virtual recreation of A.S. Popov's room with the goal of increasing visitor engagement.

The exhibit consists of a mobile application built for the Android platform, utilizing the AR Foundation framework within the Unity development environment.

The application is suitable for educational initiatives and holds particular value for museum and exhibition contexts—serving either as a virtual augmentation of physical displays or as a means of presenting artifacts not available for direct viewing.

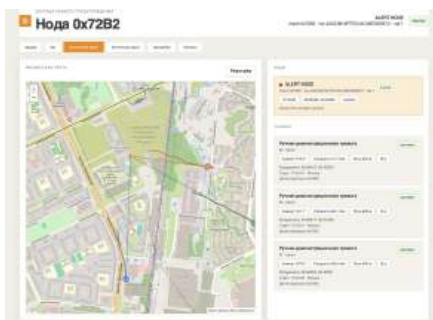
Technical specifications

All work was based on the AR Foundation documentation and official Unity examples.

Modular self-organizing LoRa mesh network platform with distributed database and acoustic early warning module

Vorozhtsov G. S.

Medvedev S. A.



Purpose

Autonomous communication at 868 MHz (SX1262) with up to 8 km range, packet routing through intermediate nodes, and decentralized data synchronization.

A distributed SQLite database with multiple replication types ensures independent node operation. The modular platform supports diverse applications, from acoustic drone detection to environmental monitoring.



Technical specifications

Hardware (Node):

- Host: Orange Pi Zero 3 (ARM Cortex-A53, Linux)
- Radio: DX-LR30-900M22SP (STM32F103 + SX1262)
- Frequency: 866–868 MHz | Power: +22 dBm | Range: up to 8 km
- Mic array (opt.): 4× INMP441 MEMS (I2S)

Modem Firmware:

- Language: Rust (no_std)
- Framework: Embassy-rs (async/await)
- Target: ARM Cortex-M3 (thumbv7m-none-eabi)
- Flash: 24.5 KB | RAM: 10.8 KB

Host App:

- Lang: Rust
- OS: Linux (Armbian/Debian)
- Stack: Tokio, Axum, SQLite, WebSocket
- UI: HTML/JS
- Binary: 3.1 MB



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