INSTITUTE MIHAILO PUPIN

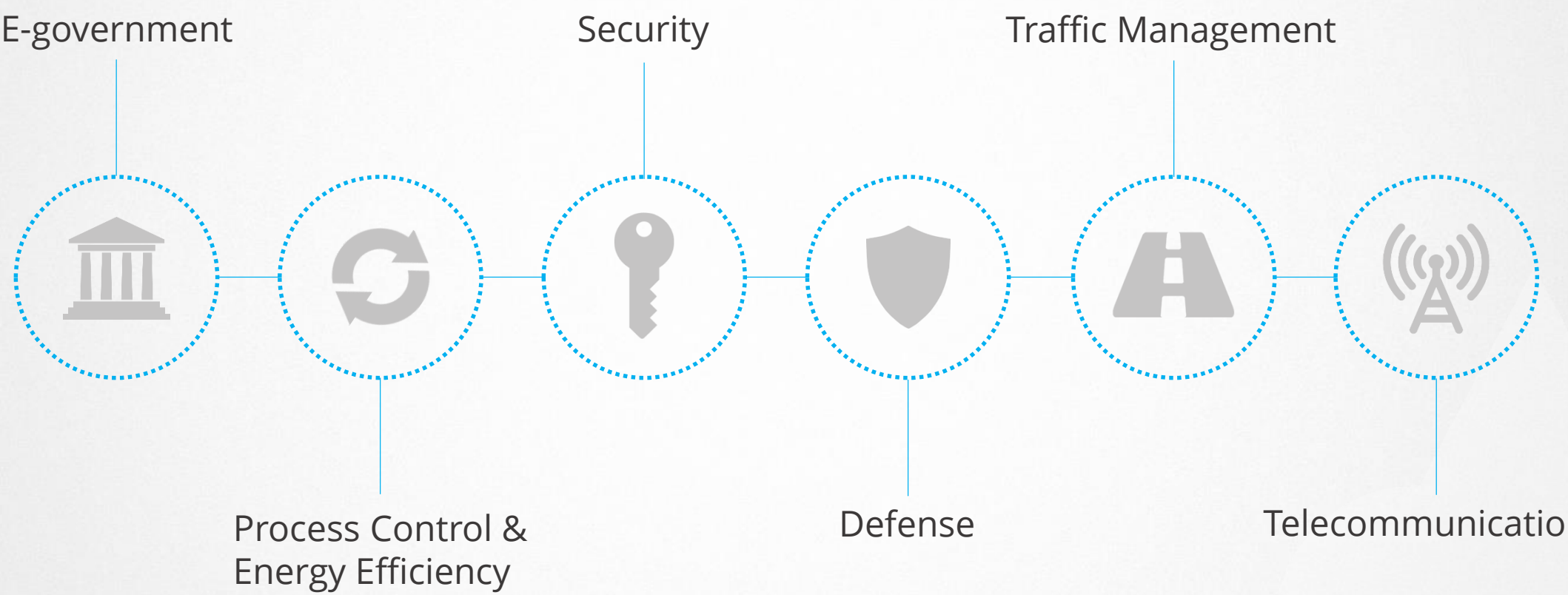
RAILWAY SIGNALLING AND TELECOMMUNICATION SOLUTIONS

institut MIHAJLO PUPIN

INSTITUTE MIHAILO PUPIN

- Leading Serbian R&D institution and information and communication technologies (ICT)
- The biggest and oldest (1946) R&D Institute in ICT area in whole Southeastern Europe
- World Bank SEE Knowledge Economy report for (2011, 2016): “Internationally competitive Institute”
- EU Commissionaire – “Pupin as the best practice example for bridging academia and industry”
- 90% of turnover via Technology Transfer

KEY RESEARCH AND DEVELOPMENT AREAS



KEY RESEARCH AND DEVELOPMENT PERSONNEL

PEOPLE

- 514 employees (350 researchers and engineers)
- Affiliated to the University of Belgrade
- Recruitment directly from University through internships/diploma/ master work
- Personnel of various ethnic origin and creed (11 languages spoken)

OUR CERTIFICATES

- **ISO 9001:2015** — Quality management
- **ISO 27001:2013** — Information security management systems
- **ISO 14001:2015** — EMS - Environmental Management System
- **ISO 45001:2018** — Occupational health and safety management systems
- **IQnet SR10:2015** — Social Responsibility Management System (based on ISO 26000)


IQNet
THE INTERNATIONAL CERTIFICATION NETWORK
CERTIFICATE
MIHAJLO PUPIN INSTITUTE
Volgina 15
SRB -11000 Belgrade
has implemented and maintains a
Quality Management System
for the following scope:
Research, development, design, consulting and engineering, testing, production, installation and maintenance of hardware (equipment and parts) and software (computer systems and applicable programs and databases) and systems, as well as trade and transport, publishing of scientific papers and R&D results and user training
which fulfils the requirements of the following standard:
ISO 9001:2015
Registration Number : RS-Q-2363-VIR

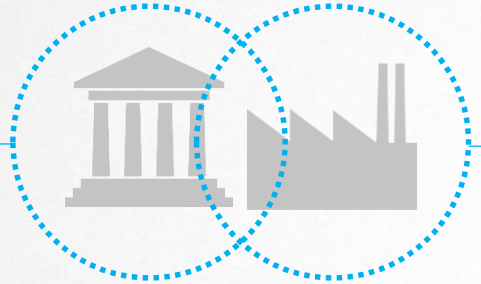

IQNet
THE INTERNATIONAL CERTIFICATION NETWORK
CERTIFICATE
MIHAJLO PUPIN INSTITUTE
Volgina 15
SRB -11000 Belgrade
has implemented and maintains an
Occupational Health and Safety Management System
for the following scope:
Research, development, design, consulting and engineering, testing, production, installation and maintenance of hardware (equipment and parts) and software (computer systems and applicable programs and databases) and systems, as well as trade and transport, publishing of scientific papers and R&D results and user training
which fulfils the requirements of the following standard:
ISO 45001:2018
Registration Number : RS-O-0640-IIIR


IQNet
THE INTERNATIONAL CERTIFICATION NETWORK
CERTIFICATE
MIHAJLO PUPIN INSTITUTE
Volgina 15
SRB -11000 Belgrade
has implemented and maintains an
Environmental Management System
for the following scope:
Research, development, design, consulting and engineering, testing, production, installation and maintenance of hardware (equipment and parts) and software (computer systems and applicable programs and databases) and systems, as well as trade and transport, publishing of scientific papers and R&D results and user training
which fulfils the requirements of the following standard:
ISO 14001:2015
Registration Number : RS-E-0888-IIIR


IQNet
THE INTERNATIONAL CERTIFICATION NETWORK
CERTIFICATE
MIHAJLO PUPIN INSTITUTE
Volgina 15
SRB -11000 Belgrade
has implemented and maintains a
Social Responsibility Management System
for the following scope:
Research, development, design, consulting and engineering, testing, production, installation and maintenance of hardware (equipment and parts) and software (computer systems and applicable programs and databases) and systems, as well as trade and transport, publishing of scientific papers and R&D results and user training
which fulfils the requirements of the following standard:
IQNet SR10:2015
Registration Number : SR-0105-RS

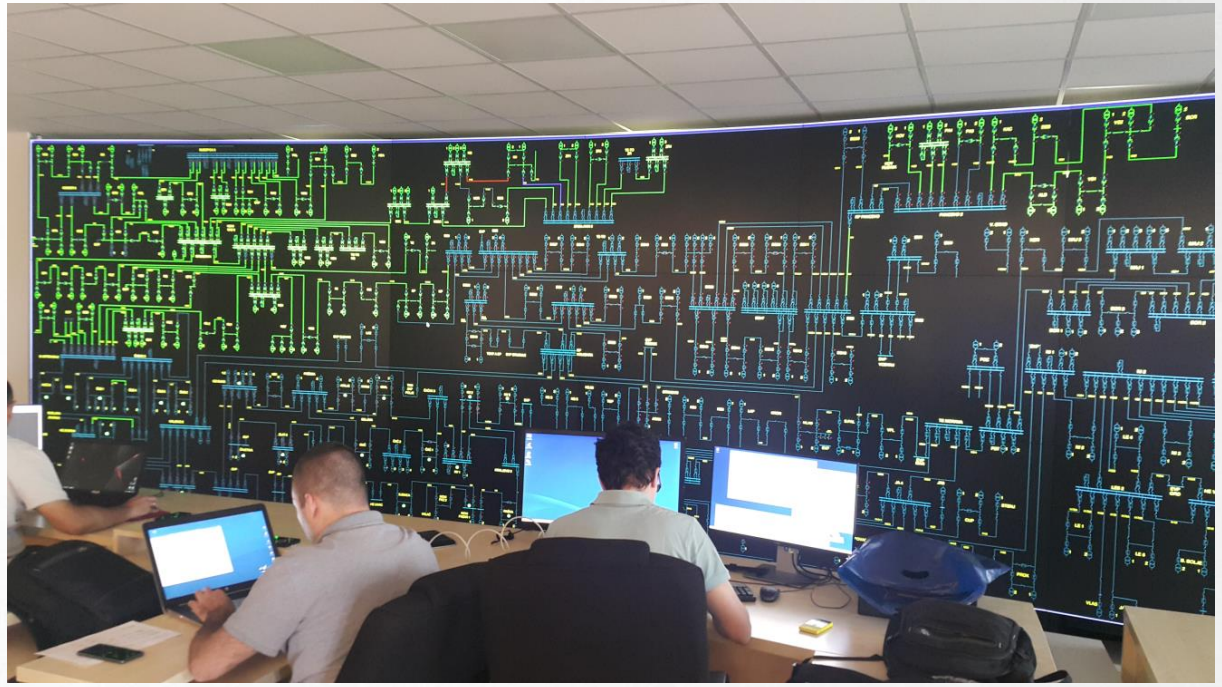
OUR CLIENTS

Public sector



Industrial sector

- Serbian Power Utility
- Water Utility
- Road, railway and air traffic authorities
- Public administration (e-government)
- Oil, gas and mining companies
- Process industries (food processing industry, tanneries, cement factories, steel mills, etc.)
- Ministry of Justice, Ministry of Interior
- Serbian Armed Forces, etc.



OUR SOLUTIONS

MAIN PROGRAMS

- **Information Systems:** E-government solutions, Document Management Systems, Decision Support Systems
- **Process Control Systems:** Power Production, Transmission and Dispatching Control and Supervision Systems, Water Supply and Management Systems
- **Traffic Management Systems:** Urban Traffic Control, Tunnel Management, Highway Pay-Toll Systems, Access control system
- **Railway Program:** Axle Counter, LED signals, HMI solutions, ...
- **Defense Program:** Simulation and Training Systems, Air War Gaming Systems, Radar signal processing systems, Electronic Surveillance Systems, Ballistic Analyzer
- **Other Programs and Activities:** Robotics, Security, Embedded Systems, Center for Gas Technique, Surveillance, Alert & Warning Systems, etc.

RAILWAY PROGRAM

TURNKEY SOLUTION

- **Strong relation to client**
  (Ministry, DoR, SRI, 100% state owned company, system requirements clarification – Alstom Transport experience etc.)
- **Support in homologation of products and sites**
  (excellent knowledge about Serbian railway norms, Rule books, interfaces to relay interlocking, etc.
- **System integration, installation, maintenance**
  SS+TT system integration on several projects already done: Pančevo station with Alstom EIXL SML400 and SpDrS64 JZ interlockings, Resnik and Rakovica stations with SpDrS64 JZ interlockings etc.
- **Products**
  Own product portfolio fully inline with Serbian norms and compatible with both relay and electronic environment








RAILWAY PROGRAM

STRONG RELATION TO CLIENT

- **State owned company**
  We are 100% state owned company
- **Tens of projects for Serbian Ministries and Public companies**
  Power utility systems, road traffic management, railway systems, e-government solutions, etc.
- **Ministry of Transportation, Construction and Infrastructure**
  Present in road and railway traffic projects for more then 30 years
- **JSC Serbian Railways, Serbian Railways Infrastructure, Srbija Voz, Elektroprivreda Srbije TENT – power plant**
  Present on almost all railway infrastructure projects in Serbia
- **Directorate of Railway**
  Serbian homologation process done for several own and other products

RAILWAY PROGRAM

SUPPORT IN HOMOLOGATION OF PRODUCTS AND SITES

- Serbian laws
- Serbian railway norms
- Licenses
- Rule books
- Serbian homologation procedures
- Interfaces to relay interlocking in Serbia
  (SpDrS-64-JŽ, Siemens based relay interlocking)
- Interfaces to other equipment

RAILWAY PROGRAM

SUPPORT FOR SPECIFIC APPLICATIONS AND INDEPENDANT ASSESMENTS

- Consultancy services on preparation of verification report required for issuing the conformity report according to Serbian national rules for logic of interlocking and other devices
- Support during independent safety assessment - ISA of the technological integration and of the vital software for interlocking and other devices, according to Cenelec or other standards
- With our partners – Certifications bodies , we can offer conformity assessment of the logic implemented for interlocking and other devices, according to Serbian National Rules.

RAILWAY PROGRAM

SYSTEM INTEGRATION, INSTALLATION, MAINTENANCE

- We have all necessary licenses for SS and TT works – I141E3, I150E3, I151E3 etc.
- Own equipment fully compatible with Serbian railway norms and rule books
- Experience in integration of other domestic SS and TT products
- Installation:
  - Own equipment
  - Other SS and TT equipment
    (including EIXL – example is Alstom EIXL in Pančevo Glavna station)
- Maintenance
  - Maintenance of own and other equipment in guarantee and post-guarantee period
  - We have license for maintenance in railway infrastructure

RAILWAY PROGRAM

ENGINEERING, PROJECT DESIGN AND BUILT DESIGN

- **We have all necessary licenses**
  SS and TT design, project for installations and built design, licences P151E3, P150E3, P141E4 etc.
- **Engineering of projects**
  Planning, cabling, preparation of materials and Works, work-schedules, solving interfaces between different producers and equipments.
- **Other**
  Institute Mihajlo Pupin with its' partners have experience also in the design of GSM-R network in several countries in the region (Serbia, FYR of Macedonia) and can help in preparation of following parts of technical documentation regarding the GSM-R network design if necessary:
  Estimation of traffic needs and network dimensioning for voice and data services;
  Frequency planning;
  Radio coverage and link budget calculations;
  Elaboration of site requirements;
  Specifications of interfaces to ETCS sub-system.

RAILWAY PROGRAM

IMPLEMENTATION OF RADIO DISPATCHING DEVICES

Experience in implementation of:

- **An analogue radio station FESA**, for the operation of the radio dispatching system. The device is licensed. Our engineers have licenses for works with FESA.
- **Locomotive radio equipment MESA 26 and MESA 23** which can be installed in a specific type of locomotive, for communicating the machine drivers with a central dispatcher for traffic management via the RD system, as well as communication with the train driver in the local work. If there is a built infrastructure, these devices can work in the GSM-R also, and we can also upgrade these devices already in use on the Serbian railways for work in GSM-R. in Serbia there are currently has the following quantity installed in analogue operation:
  MESA 26 - 21 pcs on all new sets of Stadler trains
  MESA 23 - 45 pcs on locomotives series 444, 441,461.
- **The central radio dispatcher center**, located at the central radio dispatcher for traffic communications for trains in its dispatching area – in development implementation phase

RAILWAY PROGRAM

REFERENCE PROJECTS

- **Pančevački most – Pančevo Glavna (Belgrade – Pančevo)**
  Delivery of equipment, installation, SS+TT system integration
- **Mala Krsna – Velika Plana (Corridor 10)**
  Delivery of equipment
- **Resnik – Valjevo (part of Belgrade – harbor Bar, Montenegro)**
  Delivery of equipment, installation, commissioning
- **Rakovica – Resnik (Belgrade ring)**
  Delivery of equipment, installation, SS+TT system integration
- **Podgorica (Montenegro), TENT Power Plant, Zezelj Bridge,**

  and other smaller projects
  Delivery of equipment, installation, putting in operation

RAILWAY PROGRAM

PANČEVAČKI MOST – PANČEVO GLAVNA (BELGRADE – PANČEVO)

- September 2014 – November 2016
- Beneficiary: RZD International Ltd., Belgrade Branch / Serbian Railways Infrastructure
- Length of section:
- Works:
  Construction and installation works on the construction of signaling, centralization, blockade and communication system on the facility "The second railway track on the section
  Pančevački most – Pančevo Glavna
  (Consortium Partner with Alstom Transport)

RAILWAY PROGRAM

MALA KRSNA – VELIKA PLANA (CORRIDOR 10)

- October 2015 – October 2016
- Beneficiary: RZD International Ltd., Belgrade Branch / Serbian Railways Infrastructure
- Length of section:
- Works:
  Delivery of equipment

RAILWAY PROGRAM

RESNIK – VALJEVO (PART OF BELGRADE – HARBOR BAR, MONTENEGRO)

- December 2016 – December 2017
- Beneficiary: Bombardier Transportation (Signal) Ltd / RZD / Serbian Railways Infrastructure
- Length of section: 77,625km
- Works:
  Delivery of equipment, installations,
  commisioning of 10 railway stations

RAILWAY PROGRAM

RAKOVICA – RESNIK (BELGRADE RING)

- May 2017 – in progress
- Beneficiary: CCECC (China Civil Engineering Construction Corporation) / Serbian Railways
- Length of section: 7,428km
- Works:
  Delivery of telecommunication and signaling equipment, installation, putting in operation, system integration
  (Main subcontractor for SS and TT)

RAILWAY PROGRAM

PODGORICA, MONTENEGRO

- June 2017 – in progress
- Beneficiary: AZD / Railway Infrastructure of Montenegro - AD Podgorica
- Length of section:
- Works:
  Delivery of equipment , installation
  and putting in operation
- … and other smallller projects…

RAILWAY PROGRAM

PRODUCTS

- Universal Train-wheel Detector – **UTD**
- Train Axle Counter – **BROS**
- Universal LED module – **LL-000**
- Main, Shunting, Limit Track LED signals
- Railway LED indicator signals
- Railway safety HMI – **MMI10**
- Signal Control Device – **m2SCD**
- Voice recording system – **ATIS VC-MDx**

The Pupin Atis VC-MDx registrar

RAILWAY PROGRAM

UNIVERSAL TRAIN-WHEEL DETECTOR – UTD

- Reliable and accurate train wheel detection
- Internal system integrity monitoring
- Designed for simple installation and maintenance
- Installation time under 15 minutes
- Uses existing wiring / infrastructure
- Self adjusting upon start-up
- Virtually maintenance free
- Maximal wheel detection speed – 300km/h

RAILWAY PROGRAM

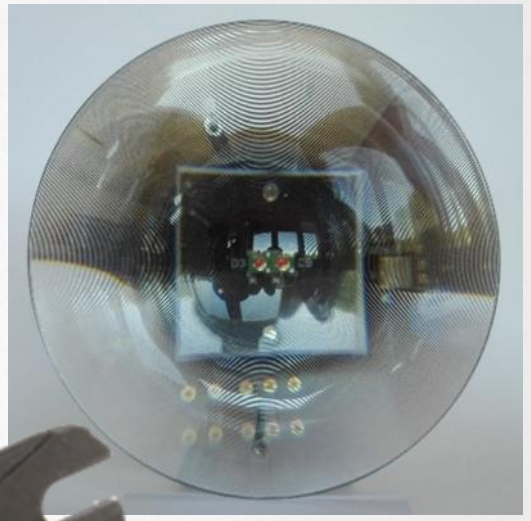
TRAIN AXLE COUNTER – BROS

- Control of up to 8 railway sections
- Up to 12 sensor pairs can be connected directly to the BROS
- Modem communication with up to two remote axle counters
- Adjustable power supply: 18V - 72V DC or 220V AC
- Operating temperature range: - 40 °C to + 70°C
- Reliable detection for train speed up to 300 km/h
- 19” standard board rack, 3 U height 84 pitch units width
- Interfaces to relay or electronic interlocking

RAILWAY PROGRAM

RAILWAY LED SIGNAL MODULE – LL-000

- Fully compatible as a replacement for two-filament incandescent light bulbs
- Adjustable operating current
- Day / night-time operation
- Blinking operation
- Early warning (in single-filament setup)
- Auxiliary filament operation and cold testing (in two-filament setup)
- Easy adjustable for both relay and electronic interlocking environments



RAILWAY PROGRAM

MAIN, SHUNTING, LIMIT TRACK LED SIGNALS

- Based on LED module LL-000
- Colours chromatic coordinates in accordance with JŽS S2.003
- Projected service life 10+ years
- Relay and electronic interlocking environments are supported
- 1000+ already installed

RAILWAY PROGRAM

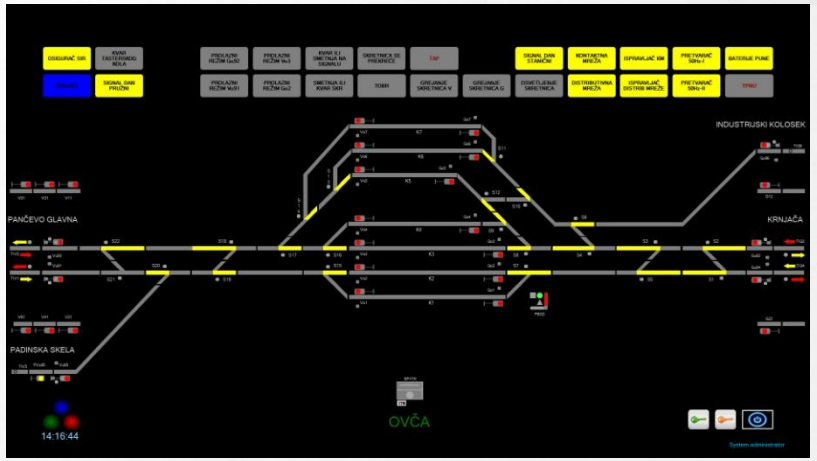
RAILWAY LED INDICATOR SIGNALS

- Addition to main railway signals (provides alphanumeric characters and symbolic drawings)
- For route indications and speed limit, for allowance of train pass
- No changes necessary in the interlocking system
- Long service life
- Different applications: railway, metro, tram
- Possible adaption according to customer requirements

RAILWAY PROGRAM

RAILWAY SAFETY HMI – MMI10

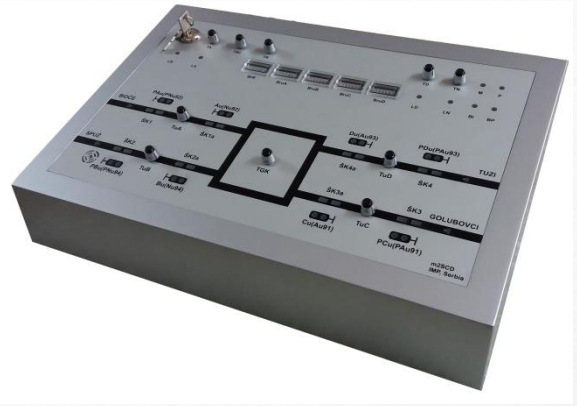
- Convenient for upgrading of relay interlocking environment
- System for administrating, monitoring and controlling one or more railroad interlocking devices
- Provides a graphics-based visualization that makes railroad standards compliant with user interface, safe and easy to use at the same time
- Highly customizable and available in different languages



RAILWAY PROGRAM

SIGNAL CONTROL DEVICE – m2SCD

- Mobile signal control device for signal control during reconstruction
- Signal control for small station with manual switch control
- Four entrances – typical configuration
- From 2 to 6 entrances on demand
- Safety control during establishing the routes
- Automatic and manual canceling of routes
- Integrated counters for routes and special commands
- High battery capacity



RAILWAY PROGRAM

WAYSIDE RADIO DISPATCHING SYSTEM - DRDC

- Consists of several elements, all of which are interconnected in a LAN
- The main elements are:
  - **Dispatch control panel** - control panel through which calls are initiated, commands are given, information and calls are received
  - **Server** - the main control and central part of the D-RDC system, allows logical connection of all devices, manages calls and telegrams and forwards them to the appropriate system entities
  - **Media converter** - a device that supports communication according to the UIC 751-3 standard, on one side has an analog interface that allows connection to a four-wire modulation line, while on the other side has a LAN interface for connection with the server

RAILWAY PROGRAM

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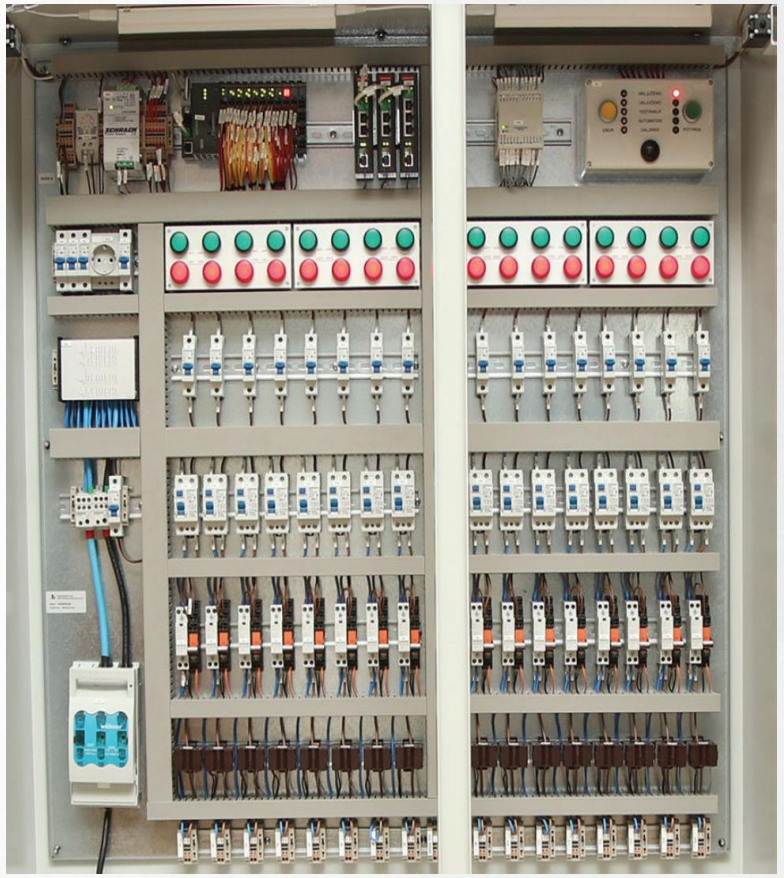
POINTS HEATING SYSTEM – GS20



- GS20 is the railway switch-points heating system
- Main parts of the GS20 system are distribution points that are controlling heaters
- GS20 system supports both centralized and distributed control architecture
- GS20 system supports both local and remote control
- User can generate commands for heating on different levels: station, region, distribution point, switch point and heater level
- System supports various types of heaters
- GS20 supports both automatic and manual mode of operation
- Support for automatic periodical testing of the heating system operation
- Support for connection with various interlocking systems
- Possibility to use dedicated MMI for GS20 system or connect to existing station MMI

INTERNATIONAL COOPERATION

institut MIHAJLO PUPIN

LONG-TERM ORIENTATION TOWARDS CROSS-BORDER COOPERATION

- Fraunhofer – Pupin Joint Project Office, established 2003
- H2020, FP7,Interreg/CADSES, Interreg/Danube, SEE, CIP/EIP, EEN, IPA, COST, Tempus, etc.
- Alstom
- Bombardier
- Kapsch
- Motorola's Application Partner
- Raytheon, USA (air traffic control)
- Monteria, USA (outsourcing)
- FINSOFT, England (outsourcing)
- LAM Research, USA (outsourcing), etc..

INTERNATIONAL COOPERATION

PUPIN'S WORLD WIDE PRESENCE