Intelligent Vehicle for Passengers Transport - VISCET

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***Abstract*—**The publication presents the results in a research grant [9] on the specific equipment regarding the communication systems specific to the rail intelligent vehicles. It is presented the computing equipment designed in order to provide a wide range of communication ways between both equipment in the same car but also between different coaches in the same convoy or adjacent convoys

***Keywords*—** intelligent vehicle, passengers transport.

I. Introduction

THE development of European countries has been challenged the extension of the researches of the systems and technologies in the railways field. This one is made around ERRAC (*European Rail Research Advisory Council*) since September 2002, becoming in less two years the main promoter of researches and developments in the railways field.

The manufacturers of the railways means (trams, light trains, metro systems) together with the sub-regional transport arrogate around them about 50% of the market, namely around 36 millions of passengers/yearly from the total persons who access the market of the railways transport services. [2],[6].

.The development of the politics of the urban and regional railways transport is an important horizon for the producers, for authorities and also for the operators in all European cities.

Built on a long tradition in the domain of the production for the Romanian national railways, the specific industry in our country has suffered, as the economy as a whole, because of the restructuring in the years 1990-2000.

Similar to the European railway industry, the Romanian plants were aligned to the standards and the development plans of the national railways. The decline of transports by rail that followed the suppression of CAER was visible in the rhythm and the quality of the orders of the production units, which were forced to restraint their activity and concentrate on repair works for the traditional clients or the new foreign ones.

The privatization of the industry meant the start of the recovery in this economic sector. The dynamism of the new owners and the orientation towards the real needs on the market brought the first major change. From reactive actors, the Romanian manufacturers became proactive and proposed to the markets technological solutions that are meant to respond to the real needs of development and not to those of the railway. The centers of research and development have successfully moved to the private sector and the big production units adopted a new technology and started to introduce quality standards similar to the Occidental ones.

In order to provide a high competitively of the railways transport against to the road transport, it is necessary to increase the increase of the traffic speed. This means to carry out electric inter-urban trains having a speed higher than 120km/h. These trains must accomplish certain technical additional conditions [7],[8]:

-speed between 120 - 200 km/h;

-increased comfort, including air conditioning units and low noise level;

-high number of ergonomic seats, comfortable for long travels;

-acceleration and deceleration be not very high, this involves the possibility that in the train composition have or many carrier cars (trail cars) and thus all the axles must not be driving axles, the train may have a light locomotive at both ends, or the train structure may include more driving cars with driving cars or trailer cars at the two ends;

-installed power enough high (2000-8000kW) and high specific powers (11-25kW/tf) depending on the trailed train length

The development of the structural and functional complexity of a locomotive, by implantation of many requirements but also restrictions concerning the safe operation and high degree of efficiency of the whole assembly has produced an increase of the monitoring factors within the specification limits, all these being vital in the operation of the railways vehicles.

The engineer's researches have created functional patents for assemblies or subassemblies from one locomotive structure

Interconnection of these patents, the interactions between them and also the driving task of the whole system become more and more complexes, requiring attention, reaction capacity but also the detailed knowledge of the operation.

All these were the locomotive driver task diminishing his attention for the proper driving activity and for the traffic events.

In this way, the solution was found and implemented by the programmable devices that have been taken the adjustment tasks, the automatic carrying out of a procedure, the controls sequence, maintenance of certain parameters within certain limits, monitoring of the critical parameters in the motors, pneumatic installations, or auxiliary circuits operation.

All these aspects have been quantified in functional procedures, translated in the automatic devices language and implemented into functional structures, independent or centralized by a single board computer.

Also, the passenger comfort was study and make same mathematical models to be implement in the system for dynamic parameter monitoring and controlling[1].

All railway vehicle passengers and staff will experience some degree of vibration. The effects of the vibration depend on the waveform, magnitude, direction and duration, and can be broadly categorized in terms of issues of perception, comfort, health, performance (physical and cognitive) and motion sickness. It is important to minimize the effects of vibration on passengers and staff to protect their health, to maximize their productivity and in order to comply with relevant health and safety recommendations and legislation (e.g. European Commission 2002, HMSO 2005).

II. VISCET - Intelligent Vehicle

VISCET is a sub-urban train with 3 cars that will be provided by an interoperable system for the circulation on the European corridors, with computerized system for the control of railways electric traction equipment and specialized products

With computerized system for the traction and breaking control, computerized system for control and monitoring of the auxiliary services, including these regarding the passengers comfort, communications system and train control (Train Management System-TMS), including "multiple control", vehicle diagnosis and continuous control of the speed for the circulation safety; power electrical and electronically systems, specific for the vehicle driving, etc.

By modernizing of the rolling stock, the railways transport can compete with the road transport that is in real increasing

The railways future proposes to reach the objective of « equilibration of the modes« included in White Book – The European transport politics for 2010 (CE/2001) .

III. Established Objectives

Within VISCET project [5], [14] the established objectives are:

Design of the structure of an intelligent railways vehicle for the safe and efficient transport of the passengers and goods with the goal to restart the fabrication of electrical sub-urban trains in Romania;

Finding of the passivity of how to use the existing electrical multiple unit of 2720kW for carry out an prototype which can be homologated as intelligent vehicle;

Researching, Design and manufacturing of a computerized system for: traction/breaking control; monitoring of the auxiliary services; communications and train control ((Train Management System-TMS); vehicle control signaling and diagnosis; information and passengers comfort.

Restarting of electrical railways vehicle in Romania, compatible with EU requirements, able to be used in East of Europe area;

Application of the up-to dated technology in the railways vehicle manufacturing and operation;

Increasing of the energetically efficiency of the railways electrical vehicle, decreasing of the railways transport costs against the road transport;

Creation of the technical conditions for putting into application of SNTFC strategy („ORIZONT 2025") in the electrical vehicles field and implicit of the National Plan of Development 2007-2013;

Using of the specialized human resources (high education system, design, manufacturing) in the field of the electric traction of Romania;

IV. Communication Systems on the Intelligent Railways Vehicle

Regardless that the train sets consist of separable cars (automatic coupled or no, as the international sets, type TGZ, ICE, metros, electrical multiple units, the architecture of the communication systems is conceived on two levels.

The first level is that connects the vehicles between them and provides by a standard interface the communication based upon established and standard imposed protocols.

The second level is within the vehicle, and it can be different from different type of vehicles, depending on the producer or the origin country. However, the basic equipment that provides the comfort, the safety then, access, the passengers information must have unique and similar access ways. The access from the first level to the second one and inverse is made by a Gateway with the role to identify the vehicle within the convoy. The structure of the connecting diagram can be performed conforming to fig. 1,

The train control system and the communications system used on the modern vehicles is modular and covers the whole application range for the locomotives and regional trains. The system is used as solution for the control, monitoring and diagnosis of the modern vehicles.

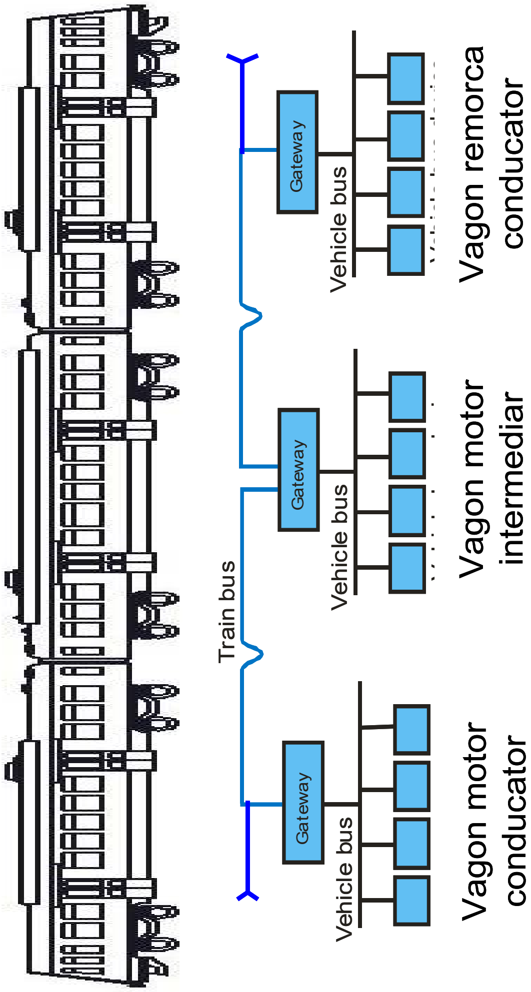

Fig. 1 - Architecture for communication vehicle intelligent

The components of the control and communication system are compact and shared in compartments

They are powered supplied from the vehicle supply and must be easy mounted in un-centralized manner.

Due to miniaturization, the numbers of components, connection cables and weight have been significantly decreased

The systems are using the standard for train network (TCN-train communication network), base on the international standard IEC 61375, for the information change of the whole vehicle[11].

Cables screened and optical fiber can be used for serial data lines. The components are connected to the same network and can change processes and diagnostic data and also it can add new modules.

The functional needs of railways for communication systems can be divided into two sections

- EIRENE requirements commonly defined by European railways
- Country- or operator specific requirements deriving from an railway operators need

A main goal of UIC is the usage of GSM-R band to realize boarder crossing international high speed trains without change of equipment at the national boarders. To achieve this each individual railway has to negotiate with the countries telecommunication regulator to get this frequency band reserved.

Nevertheless, frequency bands free for use by GSM-railway may differ in individual countries (especially in non UIC countries) due to national regulations (e.g. GSMR-band occupied by military, national security ...) and have to be agreed. If the frequencies will be outside GSM-R band, GSM-R applications are still possible but boarder crossing traffic may be not functional due to different frequency ranges.

This subset of communication requirements was studied and identified by representatives of the European railway operators and shows all applications which allow economic operation of Railway communication today and in future. The figure below shall give a short overview.

Railway signalling requirements	Automatic Train Control
	Remote Control
Operational voice communication	Train Controller-Driver Operational
	Emergency Area Broadcast
	Shunting Communication
	Driver-Driver operational
	Trackside Maintenance
	Train Support Communication
Local and wide area (non operational) voice and data	Local Communication at Stations
	Wide Area Communication
Passenger oriented	Passenger Services

Fig. 2 GSM-R applications as identified by EIRENE

V. Equipment for Intelligent Railways Vehicles

Discontinuous automation problems have long been treated on the basis of logic circuits with electromagnetic relays [3]..

Using electronic circuits in the semiconductor industry marked replacement of the relays with an asynchronous static logic, whose sub-assemblies are constituted by discrete components by interconnection [4],[8]. This becomes possible extension of logic working with relays.

A feature common to a group of important management systems that are carried out independently with relay circuits or transistor circuits lies in that they command devices such as coils, electro-vane, contactors, lamps and that the signals coming from entrance limitation race, with buttons return and other similar items

Each application requires that the designer to select a unique combination of elements of processing signals relays or transistor circuits and connect them in a particular way to achieve the desired function; accordingly, there are few similarities between different applications, leading to the increase in cost.

Elaborate the electrical diagrams, of specific circuits of the documentation execution cannot be targeted only when known fully functional specifications of the system, subsequent amendments to achieve the system cannot be done in the short term and low cost

Programmable devices have exceeded the technical and economical performances of the control devices, carried out in a logic of wiring, through increased capacity data processing, flexibility in adapting to the requirements of the process led (by simply re-programming), facility of programming.

For applications characterized by high complexity response time's extremely low, complex arithmetic calculations, multiple transfers' data, management processes becomes possible only by using systems with microprocessor

A programmable device, considered a "black box", interacts with the environment in that at a time "t" is the subject of an input signal u (t) and in response thereto, to provide exit at time t + Δ t a signal output y (t).

The fact that both input signals and the output are usually series of binary values 0 logical and 1 and that the input and output sequence is done in order sequential justifies the name of sequential logical scheme under which define automatic programmable devices.

We call programmable automatic device (Mealy according) a orderly function of number of 5 parameters

$$A = (U, X, Y, f, g) \qquad (1)$$

in which U, X, Y and are non-null quantity f and g functions are defined in these quantities. The scheme corresponding to this definition is shown in Fig. 3

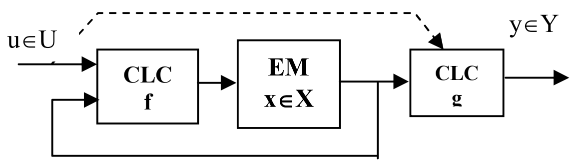

Fig. 3 - Definition of the programmable device

The quantity U represents many input signals (finite number); many X represents a lot of finished of states (x X); many Y represents many finished output signals; function f: X X x U → called the transfer function: by it is specified the state in reaching the programmable device after the application of an entry (future status).

The function g: X x U → Y is called the output function, by it is specified the output that the programmable device offer after application of an entry (next entry).

Information is worn in the direction indicated by arrows. The circuit that calculates f and g is combined circuit (CLC) and the memory storage EM allows the storage of the current state of the programmable device (state in the time).

VI. Software and Hardware

If a structural achieving a degree of availability and certainly desirable, is based on modules of the UC redundancy, and interface with the process and connecting channels I / 0 in closed loop, programming of the automatic devices create a functioning far more secure than if wired logic at a cost comparable

VII. Software

To create a quasi-continuous command manner similar to that obtained by logical type cabled, similar to that obtained by logical type cabled, as well as conferring a high degree of safety and operational availability, the user is organized in subroutine enabled resources type in real time clock, according to a basic program executed at the time of the coupling voltages

Thus a number of subroutines performed successively define a cycle program after running the last routine of the current cycle being reactivated unconditionally the first routine of the cycle. A cycle- program (control of the process) will contain all the required routines to ensure the order itself, according to a combinational algorithm or sequentially and a number of programs function test, carried out partly or entirely in a cycle. For entries with a rapid dynamic (switching time comparable to the duration of their program) is recommended to be testing during a multiple-cycle program, or their acceptance in conjunction with a system interruption.

A procedure to eliminate the influences software parasites that can induce in some channels vibration, for example due to mechanical vibrations, consists of validating the changes status variables I / 0 only if this change remained for two cycles of control; way it can be removed the static hazard and dynamic from the UC circuits.

At a certain number of cycles are enabled by auto test routines: check access to EPROM and RAM memory, functional status of UC's, access to other resources hardware UC (system breakdown, watches and real times). The complete self-testing of UC should be completed in less than a second being shared in such a large number of cycles program.

VIII. Hardware Equipment

Due to the fact that the miniaturization of the computing devices has enabled the achievement of process computers with enhanced capabilities and applications run by the increasingly complex, they can be used to ensure the functioning of ancillary services.

Computer equipment designed to apply the railway must provide a wide range of modality of communication between both equipment in the same car but also between different coaches in the same convoy or adjacent convoys. The ways of communication are shown in Figure 4.

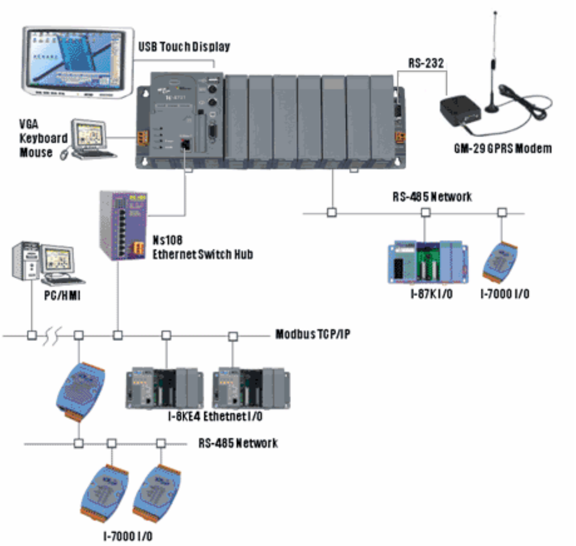

Fig. 4 - Ways of communication between equipment

The development of this equipment started from the desire to implement a new concept in the design and manufacturing of electrical equipment that serve a specific purpose.

Starting from the electric diagram structure of the design of the electrical train in our own country, one can identify within the auxiliary service equipment many components that have a role in passenger comfort. These components must work independently from the train's main circuits (power supply, traction, brakes, train driving).

Electric auxiliary carriage interior installations must ensure the adequate functioning of interior services for the intelligent vehicle, including: interior lighting, locking and unlocking of doors, acclimatization and heating inside the vehicle. This kind of installations can be installed in various locations within the vehicle, as, for instance: driving cabin, passenger compartments, lanes, special compartments for auxiliary services, pneumatic compartments, technical compartments, main passage, roof, etc.

A major advantage for this type of equipment becomes evident even from the design phase, and namely its powerful modularity and adaptability to the demands of the controlled process. Flexibility comes from the fact that the command and state monitoring channels can easily be multiplexed when the demands of the controlled process have increased. At the same time, changing the operating mode can be achieved by a simple software upgrade. This upgrade can be tested in the design phase and compiled on a test bench, without an impact on the availability and operability of vehicles in active use.

To achieve the conditions for "multiple command", where two or three trains are joined in a convoy with a single command point, the communication facilities provided by RS232/485 interfaces or Ethernet are being used. Using this communication links, the software exchanges data regarding main monitored parameters, any events that may have occurred during operation and can, receive, optionally, commands for state changes in the operation modes.

IX. Command Systems for Vehicle Lighting

The electrical installations for vehicle lighting must assure the illumination of the entire vehicle (drive wagon, intermediary drive wagon and trail car) trough florescent lamps (when train is connected to the main power) and bulbs (when train is on the reserve power supply) or by LED technology which can function in the both situations[10].

Control of interior lighting is achieved separately for each section, either by automatically engaging contactors by the computing equipment, either manually from the panel switches and command circuit closers.

The intelligent vehicle system – the programmable automaton – is built on an embedded platform which combines within the same equipment a PLC (Programmable Logic Controller) and an IPC (Intel Process Communication) for data exchange between different equipment achieved through a network bus.

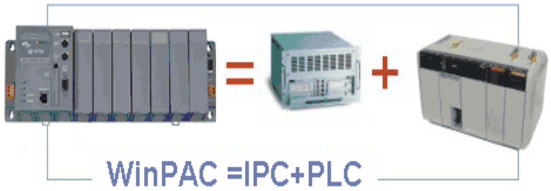

Fig. 5 - Equipment with dual function.

The main unit is equipped with an Intel Strong ARM CPU. Its operating system, Windows CE 5.0, has many advantages, including hard real-time capability, small core size, fast boot speed, interrupt handling at a deeper level, achievable deterministic control and low cost. Using Windows CE.Net 5.0 in the WinPAC-8000 gives it the ability to run PC-based Control software such as Visual Basic.NET, Visual C#, Embedded Visual C++, SCADA software, Soft PLC …etc. see figure 6

Fig. 6 - Base software platform

X. Door Command System

The design different type of application depending of the deferent job and tasks. They are a main application and a set of complementary applications for testing, alarms and special diagnose.

Applications in standard operation regime are activated manually by the operating personnel on the intelligent vehicle; this can be the driver, conductor, or other on-board personnel, or automatically by the vehicle's intelligent system. The manual activation of these operating modes implies a procedure that involves secure access to the vehicle's command panel.

The software applications for the programmable automaton responsible with illuminating will monitoring all the parameters regarding light intensity both within the vehicle and in the outside of the vehicle, and, depending on these values, will establish the operating parameters for the illuminating installations, individually for each coach within the train. The values measured for the electrical consumption, the state and function of each lighting element and sensor will be permanently displayed on the equipment's display. Depending on the lighting conditions (day/night), the application will activate the watch lights, the reading lights, the aisle lighting and/or stairs and access area lighting, exterior and navigation/tail lights.

At the same time, the software will be able to apply commands received from the control post regarding interior lighting settings in specific areas of the intelligent system. A special purpose will be assigned to illuminating procedures in case of switching to reserve/backup supply or emergency situations.

The software application for the door control programmable automata will monitor the adequate functioning of the installations which control the doors of the intelligent vehicle. The application will monitor the motion state of the vehicle, its position along the traveling route, the good operation of the hydraulic door movement equipment, will provide audible and visual signals to warn of the activation of opening or closing of the doors, and will provide centralized information to the operating personnel regarding the secure positioning of the doors while the vehicle is traveling[15].

At the same time, the application will allow the opening of the doors only once the conductor will allow this and only on the side with the access platform in the station. When the vehicle starts its travel, when the 10km/h speed is reached, the application will automatically trigger the closing of the doors, not allowing the vehicle to increase its speed until all doors are securely closed. Any accidental opening of a door during the travel of the vehicle will be treated as a fault signal and will be sent to the intelligent vehicle display system. The information will be visible both on the conductor's display and on the equipment's display.

XI. Testing of the Command and Lighting Equipment

These software applications are designed to perform testing of the process functions that are being monitored[12]. The applications are stored on the non-volatile memory of the programmable device and can be invoked from the automaton's display by the maintenance personnel when the vehicle is being serviced. The interface of such an application is shown in Figure. 7.

Module I- 8017H - module for analog input signals				
No	**Chanel**	**Generate value Val$_{gen}$**	**Measured value Val$_{mas}$**	**Difference**
1	0	7,000 [V]	6,998 [V]	-0,02857
2		9,000 [mA]	9,010[mA]	0,11111
3	1	7,000 [V]	6,997 [V]	-0,04286
4		9,000 [mA]	8,997 [mA]	-0,03333
5	2	7,000 [V]	6,999 [V]	-0,01429
6		9,000 [mA]	9,000 [mA]	0,00000
7	3	7,000 [V]	7,001 [V]	0,01429
8		9,000 [mA]	9,001[mA]	0,01111
9	4	7,000 [V]	6,997 [V]	-0,04286
10 …..	……..	9,000 [mA] ……….	9,001 [mA] ………….	0,01111 ………….

Table 1 - Values obtained at equipment verification.

Modul I- 8024 – modul with analogic output				
No	**Canal**	**Generate value Val$_{gen}$**	**Measured value Val$_{mas}$**	**Difference**
1	0	4 [V]	4,001 [V]	-0,02499
2		12 [mA]	11,998 [mA]	0,01667
3	1	4 [V]	3,997[V]	0,07506
4		12 [mA]	12,000[mA]	0,00000
5	2	4 [V]	3,997 [V]	0,07506
…	…… ..	……….	…	……….

Table 2 - Verifying analog exits.

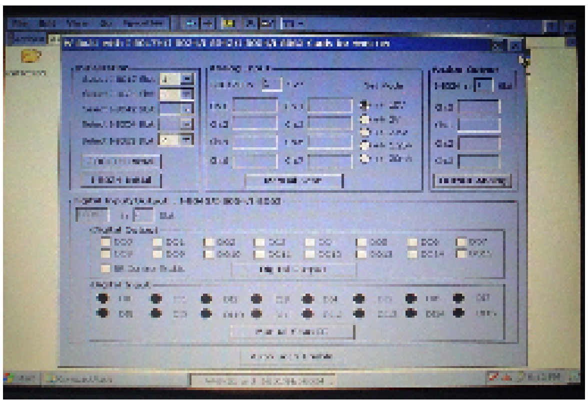

Fig. 7 - Interface to test equipment

Through this control application the maintenance personnel can perform operational tests on the system, as well as tests specific elements and adjust the system for the measurements performed by various sensors[13].

Based on such equipments, we have performed tests and measurements to evaluate the response of the equipment to software commands. Several reaction channels have been monitored when calibrated signals have been applied. We have considered that the values measured or generated by the equipment should be calibrated as these are directly dependent on measurement devices for continuous values (temperature, light, electrical currents, etc). It is important that equipment which monitors the passenger comfort in an intelligent transport vehicle can follow the time-based evolution of these parameters, to allow predictions and calculate tendencies of evolution. The precision of these measurements as well as the "noise" of received signals directly influence the behavior of the equipment within the limits imposed to the system. In Table 1, for instance, we can observe the values obtained for measuring entry channels for analogue measurements. In Table 2, we can observe the errors that appear when testing the channels for analogue exits.

XII. Building a Prototype

To design the locations and placing of the equipments, we have took into consideration the technical requirements for the platform of the intelligent railway vehicle, including shock, vibrations, temperature variations, protection against dust, noise and electromagnetic interference[8].

Based on data provided by the equipment suppliers and the established railway vehicle design standards, we have built several virtual models of the equipments designed for monitoring the specific processes. Using CAD software, three-dimensional models of the equipment have been constructed and have been used to investigate ergonomic aspects, functionality, cabling and the choice of different locations and structural design, see fig 8

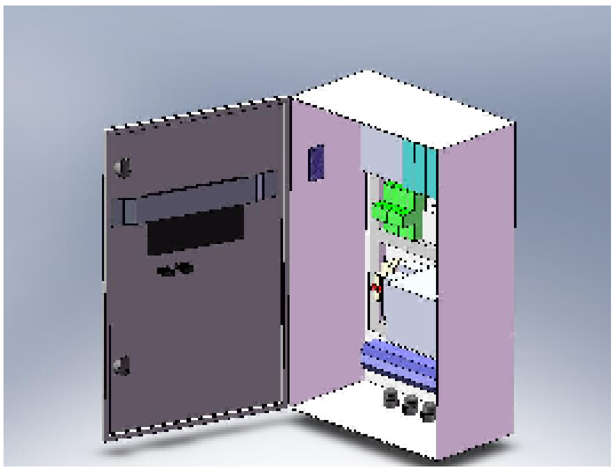

Fig. 8 - 3D modeling of prototype

Following the final version of the three-dimensional models, specifications for execution have been drawn for the components and sub-components of the equipment.

The execution also is realized for the prototype for testing the concepts and project, see fig. 9

Fig. 9 – Internal view of equipment

On the front panel the communication equipment is placed, consisting of a 7” touch-screen monitor, which allows the input and execution of commands using on-screen menus.

Underneath this equipment, two USB ports are being located which allow the connection of standard peripherals as a keyboard or a mouse(fig. 10). These can be used to activate applications for various operating modes of the vehicle.

Within the modular boxes several power sources have been made available for various computing devices, which can be connected to the non-interruptible power sources of the vehicle (e.g., batteries), but also other sources for powering the equipment with the box (relays, contacts, input/output circuit boards, according to Figure 4.2.5). Next to the power supplies, protection equipment against short-circuiting or over-loading of the equipment are provided, which serve also as a disconnecting switch.

At the same time, the equipment is provided with a chain of clamps, each marked for connecting the microprocessor system with the exterior equipment. The types of clamps have been selected to allow measurements to be performed, bridging of circuits, as well as auxiliary reserve clamps for possible future extensions of the system.

Fig. 10 – Front view of equipment

Implementing the state-of-the-art technical solutions for automated process control using systems equiped with process computers is particularly advantegeous, especially following the unprecedented development of digital command and monitoring equipments. In addition, the communication features of process computing equipment allow the interactive and remote command, monitoring and diagnosis of processes, even in circumstances where these cover an entire intelligent vehicle under single or multiple command.

The possibility of future software upgrades allows the development of an intelligent vehicle with increased passenger comfort which can meet the highest standards and demands. At the same time, the intelligent systems are monitoring the run-time parameters of the vehicle. Next to the role in facilitating the driving and command of the vehicle, this also provides the support for the continous enhancement of the procedures attached to each process. We can say, therefore, that a major functionality for the monitoring process is achieved, one of three major functionalities of the system, which can be considered on three hierarchical levels.

We are talking about the *Automated control of processes and equipments of railway vehicles*. This function can be considered as the base level of monitoring, a level supervised by the human operator. The purpose is to minimise the human conductor’s intervention at this level. The fault indications at this level are sent to the display and information devices in the driver’s cabin. The high level of automation allows the design of redundant systems which detect and localise potential faults. Backup systems that are engaged automatically in case of faults maintain either the initial capacity of the system or povide a safe-mode reduced capability. This allows the development of the next level, which is required for the process of monitoring of parameters.

In a possible scenario, the intelligent vehicles can perform diagnosis and maintenance schedules even before reaching the vehicle depot. The potential faults that may appear while in service (contact faults, ventilation, transformers, motors, loss of oil, electro-hydrolic pressure systems, faults in passenger comfort systems, etc) can be logged and sent autmatically to the depot to anticipate scheduling and facilitate timely repairs. The specific technical solutions to the faults, including the necessary equipment and personnel, can be prepared in advance, allowing for „just-in-time" maintenance. The out-of-service periods and maintenance schedules are considerably reduced, increasing the viability of the vehicle through reduced energy usage and, due to increased usage and revenues, a reduced period of amortisation of the financial investment in the vehicle. For minor faults that appear while in service, repairs can be performed even while the system is in operation, or while stopped in stations, while also ensuring all the safety procedures are met.

XIII. Conclusions

This kind of project help to build a bigger, better and safer railway by:

providing a strong and coherent engineering science base for railway systems research in the UK, located in a number of universities acting in a coordinated way

- supporting and facilitating research that will enhance scientific knowledge and understanding and ultimately contribute to improved capacity, reliability and safety; increased attractiveness and reduced environmental impacts of railways
- bringing together researchers, representatives from industry and policymakers to help define, prioritize and guide research, and use the results to challenge policy, inform policy development and improve industry practice

Helped by the recovery of the Romanian railway sector and by orders issued for new rolling stock, we should wait for a strong recovery of some of the Romanian players, stand-alone or in international partnerships. This situation can be related to what we have encountered in sectors that were advantaged by an early decentralization, such as the technology of information and communications sector. There we noticed the establishment of a regional business sub-hub in Romania and we expect the same revigoration of the Romanian railway industry, too.

In Europe, each high speed train will become a transport standard for connecting the cities, our continent having an optimum size for traveling by train. Surrounding European trains will use as an option for distances greater than 1,000 km, passenger services are frequently improved, trains became more comfortable and safer, existing a large availability and easy access to high speed at a very large amount to information.

We expect from a Europe in which each local train or between cities to make part of an integrated environment, friendly, spacious and convenient alternative to road transportation. Having a minor impact on the environment and with a high degree of flexibility, with a complete integration of interoperability (means transport tickets, information ..) this transport way will become an essential element of life day by day for the Europeans, with an essential contribution to the quality of life in and between towns.

A Europe with a integrate system of railways, where the transport tasks which are taken from the origin and up to destination by a single operator. The maintenance operations and repair can be performed anywhere in Europe because of standardization and modularization. A Europe in which committees of research and development, involving manufacturing industries and suppliers of equipment, management and infrastructure operators, academies and organizations planning and development environment in the Member EU carry out trade and production development in support of technological innovations of European citizens.

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