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# Integration methods of a vehicles emergency response system based on navigational units

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**Abstract.** Studying the state of the art of current integration methods of a car engine with the automobile mechatronic system by using neural networks to orchestrate the methods of integration of a car engine with the automobile mechatronic system by using algorithmic electronic control based on new neural networks; to formulate the methodology of electronic model control of an engine with a mechatronic adapter; to design a model enabling calculation of input-output data; to analyze results of cold and hot tests of an engine, develop methods improving tests with the help of mechatronic adapter; to reason power and torque of an engine integrated with the mechatronic adapter; conceptualize the method of assessing fuel economy and environmental performances of an engine; put forward a guidance on research application and estimate economic efficiency. The article discusses the topic of improving the safety of transportation by introducing the latest capabilities of advanced technologies. The proposed solution uses the composition of engineering networks to expand such networks as ERA-GLONASS and e Call, which allows not only to transmit additional information, but also to combine information to determine the necessary means of emergency assistance and coordinate the entire emergency response operation. The key concept of the approach is to model the cyber-physical components of the human device using collections of resources that reflect them. Services have the ability to self-regulate, which allows them to independently adapt their behavior to the context of the vehicle driver's environment.

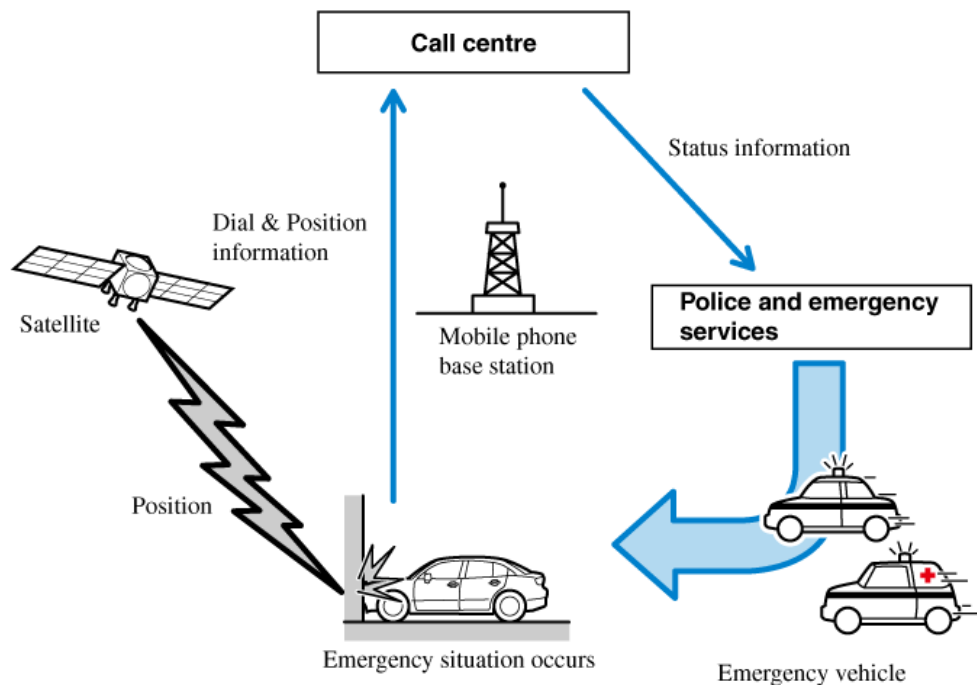
## 1. Introduction

Modern technologies allow the development of a wide range of transportation security systems. For example, the Russian project ERA-GLONASS, or the State Emergency Response System for Incidents, aims to enhance traffic safety by instantly transmitting information about a vehicle in distress, including its precise coordinates, to the regional emergency response center. E-Call is a related European initiative.

This paper suggests a solution that expands those structures by composing a service network that allows not only the transmission of additional information, but also for the combination of information in order to decide the appropriate emergency means and to coordinate the ensuing response. However, individuals are often included depending on their real-time contact. The word “cyber-physical networks” is also known as the “Internet of Things” or something similar[1]. It focuses on domain-independent architectures and systems for supporting cyber-physical objects and networks. Context-



Sensitive CPS enables new types of knowledge services through exploiting physical systems' capacity to deliver qualitative information in previously unattainable standard. Context is any information that may be used to describe the condition of the entity in question, where the entity is an individual, location, or object that is assumed to be related to the user's contact. "ERA-GLONASS" is the Russian state emergency response system for accidents, aimed at improving road safety and reducing the death rate from accidents by reducing the time for warning emergency services. In fact, this is a partially copied European e Call system with some differences in the data being transmitted and partly backward compatible with the European parent. The principle of the system is quite simple and logical: in the event of an accident, the module built into the car in fully automatic mode and without human intervention determines the severity of the accident, determines the vehicle's location via GLONASS or GPS, establishes connection with the ERA-GLONASS infrastructure and in accordance with the protocol, transfers the necessary data on the accident (a certain distress signal). Having received the distress signal, the employee of the call center of the ERA-GLONASS operator should call the on-board device and find out what happened [2]. If no one answers, send the received data to Sistema-112 and send it to the exact coordinates of the team of rescuers and doctors, and the last one to arrive at the place is given 20 minutes. And all this, without the participation of a person: even if people caught in an accident will not be able to independently call emergency services, the data on the accident will still be transferred. In this work we intend to add some information about applying ERA-GLONASS project [3] in Uzbek Roads especially mountain regions like "Kamchik" pass. Kamchik Pass is a high mountain pass at 2.306m high in the eastern Uzbekistan of the Qurama Mountains, which is roughly 88 km long. The path to the pass is paved, but the asphalt has vanished in raw areas. The name is A373. A tunnel constructed in 1999 passed the old road across the pass. On the horizon we can see the snow-capped Fan Mountains tops. The pass is in the Fergana Valley between the regions of Tashkent and Namangan Infrastructure:



**Figure 1.** Vehicles emergency response system

## 2. Integration methods of a vehicles emergency response system

The key functionality of this device is an integrated computer that constantly track crash sensors and satellite positioning receiver for automatic data and complete duplex call in the event of an emergency by means of a dedicated Wi-Fi modem (e.g. GSM, UMTS). In-band modem capability, the ability to

transmit data over the voice channel, is a key requirement for the system[4] [5] [6]. As a matter of fact, inside the car there is an ordinary mobile phone which, when the airbags are activated, automatically makes a call and “informs the operator about what happened” and that’s where the main technological “chip” of the ERA-GLONASS system and e Call: tonal modem lies. Since the system was originally designed to work in places where there may be no mobile Internet connection (even GPRS is not always available), a protocol was invented that allows transferring a small amount of emergency data called the Minimum Data Set (MND). The essence of this protocol is that all the data transfer occurs inside the GSM Voice Channel, almost like Dial Up modems in the mid-2000s, but more jam-resistant, with support for time synchronization and ARQ. The figure shows the time signature of the signal transmitted from the IVS and from the PSAP signal (inside the voice channel). ERA-GLONASS contact terminal is designed for your car. In an accident, the terminal auto-calls an ambulance call that is a cell network priority and forwarded to the system ERA-GLONASS. The driver or the passenger may make a call by clicking the "SOS" button when an accident or any emergency is involved. Information is published regarding the accident's precise site, timing and seriousness as well as VIN [7]. Once the ERA-GLONASS call center operator has screened the incorrect calls, the calls that require the response with the accident details are passed on the MIA or 112 systems where they operate efficiently. MIA call-center where the response to emergency responders is effectively facilitated and organized using this information. The back-up mechanism is available for all components to ensure the stability of ERA-GLONASS [8]. The majority of vehicles fitted with ERA-GLONASS modules "J200 GMUZ ERA GLONASS Growth" safety requirement are currently operating in our country" GM Uzbekistan (General Motors). All the parts of ERA module is equipping to the cars shown in this picture. There are can be some changes according to the internal facilities of the cars. The parts that cars equipped in GM Uzbekistan factory are made one of Italian company which is located in France. According to some facts the module itself costs around \$300 since 2016 in order to export our cars to Russian Federation and other countries like Kazakhstan and others.

### 3. Conformity testing of automated modules

To simplify the execution of complete compliance tests, the R&S ® CMW run sequencer software tool is added . This R&S ® CMW-KT110 option provides ready-to-use test sequences to perform end-to-end modem compliance testing and within the e Call and ERA-GLONASS band in line with applicable standards. The available packages verify the conformity of the modems within the voice band, according to the specifications CENEN16454, ETSITS103412 and GOSTR55530 (GOST33467). We can conveniently select and combine the required test sequences on the simple user interface. The R&S ® software CMW run automatically configures the test tools, the PSAP and, if supported, the IVS under test via remote control. Runs the selected tests and generates a complete test report indicating success / failure for each test case.



**Figure 2.** Radio asm-am/fm stereo & audio disc player 92199291 is replaced radio with p/no. 42356100 module.



**Figure 3.** Asm-comn interface and nut communication interface is new added era-module with p/no. 94537 module.

Figures 1 and 2 show that when the ability to verify compliance with standards from the first stage of a project allows you to promptly adopt corrective measures and optimize an IVS module. Generates GPS, GLONASS, Galileo, BEIDOU, QZSS and SBAS signals on up to 24 channels. The versatile and flexible configuration options allow you to create even complex GNSS scenarios. Fixed and mobile receivers can both be simulated easily, as well as ionospheric and tropospheric influences and complex disturbances that may be present in the receiver environment, for example multicam propagation, darkening and particular characteristics of the antenna.

The R&S ® SMBV-K361 options for e Call and R&S ® SMBV-K360 for ERA-GLONASS together with the R&S ® CMW run software transform the R&S ® SMBV100A generator into an automatic GNSS performance test environment. This solution automatically configures the signal generator and the connected GNSS receiver. It performs automated GNSS performance tests for the receiver of the e Call and ERA-GLONASS modules against the performance criteria specified in EU 2017/79 Annex VI, UNECE 2016/07 and GOST R 55534 / GOST 33471 and offers complete test reports.

#### 4. Conclusion

We plan to include some details in this work concerning the implementation of the project ERA-GLONASS on Uzbek Routes, in particular mountain regions such as the "kamchik pass." The Kamchik Pass is a high mountain pass, situated in the Qurame Mountains of eastern Uzbekistan and its length is approximately 88km at an altitude of 2,306m (7,565ft) above sea level. The path to the pass is paved, but the asphalt has vanished in raw areas. The name is A373. A tunnel constructed in 1999 passed the old road across the pass. On the horizon we can see the snow-capped Fan Mountains tops. The pass is in the Fergana Valley between the regions of Tashkent and Namangan.

Further studies are planned in several directions: development and implementation of transformation algorithms will ensure signal independence of the system, increasing in the size of the training sample will lead to a significant increase in the time of training and testing; as a result, the use of modern parallelism technologies, in particular, computations on graphic processors, may be required.

#### 5. Acknowledgments

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