REPRESENTATION OF DATA FUSION AND METHOD OF TESTING OF STEREOTYPED SITUATIONS IN TRANSPORT TELEMATIC SYSTEMS

Alexander I. Alexandrov

Transport and Telecommunication Institute,
Lomonosova 1, Riga, LV 1019, Latvia
Ph: (+371)-7144781, Fax: (+371)-7100660, E-mail: aia@tsi.lv

Yuri G. Barinov

Pskov Polytechnical Institute,
L.Tolstova 4, Pskov, 180680, Russia
Ph: (8112)-723990, Fax: (8112)-223281, E-mail: fem@ppi.psc.ru

Alexander V. Grakovski

Transport and Telecommunication Institute,
Lomonosova 1, Riga, LV 1019, Latvia
Ph: (+371)-7100651, Fax: (+371)-7100660, E-mail: avg@tsi.lv

Key words: telematics, decision making, data fusion, algorithmic undecidable problem, complexity, fractals

1. Introduction

The intelligent application systems (IAS) are intended for support of decision making in logistics and telematics. The decision-making is an intelligent activity, which refers to the class of algorithmically irresolvable problems. The complication of processes in systems of telematics and logistics shows in an alloy of heterogeneous dates mapped with the help of modern information technologies on Web-pages [**1**]. The first problem is connected to representation of an alloy of dates. Second problem is connected with algorithmic decidability. The complication of decision-making is instituted by complexity of a task, instead of any properties of IAS. There is a close dependence between complication of management systems and facilities for their specification statement.

The problem is soluble only in case when there is an algorithm, which gives the unique answer "**TRUE**" or "**FALSE**" for any situation. For stereotyped situations (precedents) sometimes it is possible to indicate a good solution, but it does not mean yet, that the problem is soluble. In a basis of constructing of IAS that or diverse representation, encoding and storage of stereotyped situations will be used. If to use specially fitted representation, encoding and storage of precedents, the irresolvable problems of decision-making can become soluble in stereotyped situations.

The transport telematics and logistics system is a distributed system, the heterogeneous information about its activity is dynamically imaged on page or frame. It means, that the concrete operating in the system results in variation of graphics image on page. Therefore, unit of representation and treating of an “alloy” of heterogeneous dates is the page. For representation of the page the mapping of Cantor quadrate in a segment and fractal dissectors is used. In outcome each page is represented by a chain of zero points and units, that is integer. In

turn each precedent (stereotyped situation) is represented by the succession of pages or script, which will derivate words. The script is a subject to storage in IAS without a routine of screening procedure any dates.

The succession of numbers (chain of pages or word) allows describing ***variability*** in the system telematics through the appeal to probability representations of numeric orderliness of pages, to study it the methods of mathematical statistics that establish communication between concepts of contingency and complication are used. Complication of a word and number bit of its organization coincides with length of binary notation of this number. The complication of systems depends on the description language. Augmenting vigor of language, that is a number of precedents, we receive the specification statement of the more powerful system.

The studied numeric orderliness mirrors both stability of frame, and spontaneity of evolutionary variations descending in transport telematics systems. The outcomes of studies allow receiving compact representation of precedents and method of extraction of knowledge from a fusion of heterogeneous dates. The obtained knowledge will be used in IAS for acceptance of good solutions. The good solutions are grounded on usage of all accessible information, result in positive outcome and introduce the contribution to competitive advantage entities.

Robustness and reliability of control systems are connected as to problems of backup copying and data storage, and with regenerating of precedents. These problems are decided with the help Web-technology and simulation of processes in distributed systems [**2**]. For study of management systems and the simulations as input dates the ordered pages are used, that is succession of integers and methods of mathematical statistics.

2. Method of Testing of Transport Streams on Transit Corridors

The approach to representation of the transport process is illustrated in Fig.1. The

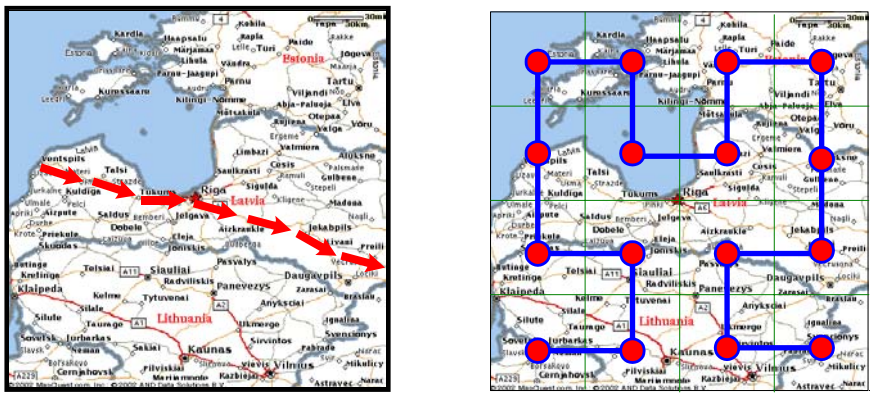

Fig. 1. *A conventional transit corridor and the Hilbert's mapping algorithm*

movement of the transport vehicle on a conventional transit corridor is schematically shown here. All terrain of region is broken into cells, which are intercepted by this transport vehicle. If the transport resource is in concrete quadrate, to this quadrate value "**1**" is assigned. If in quadrate there is no transport vehicle, the value "**0**" is assigned. All quadrates coat the region without lying and skips. Thus, the transit transport resource at any moment of time will be necessary to be in any one of quadrates covering region.

The following step to representation of a transport situation is encompass bayed volume, that quadrates to turn in a ribbon and to receive a code of a stereotyped situation by the way chains

of zero points and units. For this purpose it is possible to use different algorithms, which are carrying out mapping of quadrate in a segment. The Hilbert's mapping algorithm is used here.

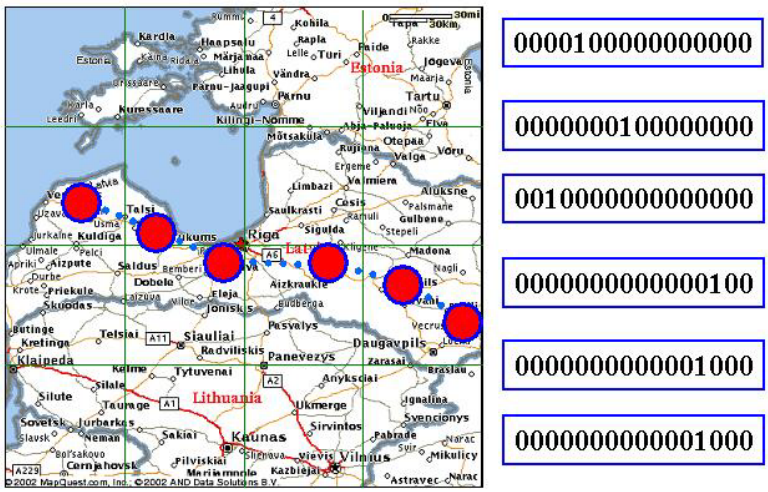

Fig. 2. *Transport flow transformation to the binary sequence*

The outcome of overseeing time of transit transport vehicles is presented by finite chains of zero points and units (see Fig. 2). Thus each snapshot or frame, which fixes a transport situation in a concrete instant in region as a whole, is presented by a separate unique finite succession of zero points and units. In turn, the succession of the snapshots is endless, as the transport flow is not discontinued and it is necessary to fix a transit situation around-the-clock. For a solution of a problem of round-the-clock supervision behind a transit corridor the system of telecommunications of region (Fig. 3) may be used.

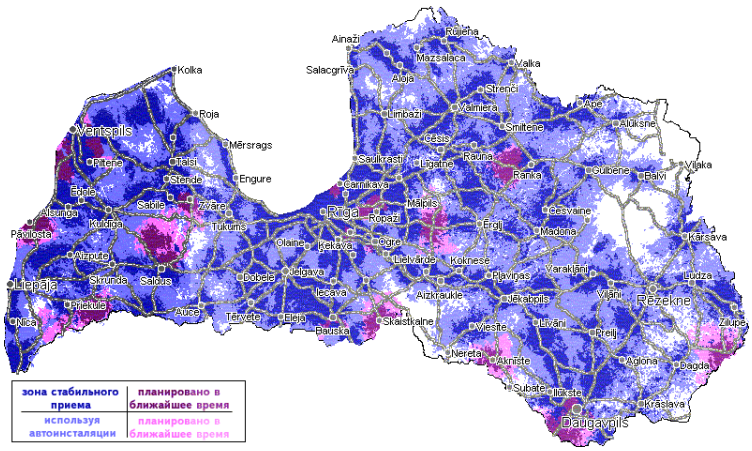

Fig. 3. *The system of mobile telecommunications of region*

The actual dynamic transport situation in transit corridors of region is represented by an infinite succession of zero points and units, mirroring data fusion about all transit transportation vehicles. The purpose of analysis of an infinite succession of zero points and units is eliciting the hidden legitimacies. Thus the elongated initial pieces of this succession (Fig. 4) are esteemed sequentially.

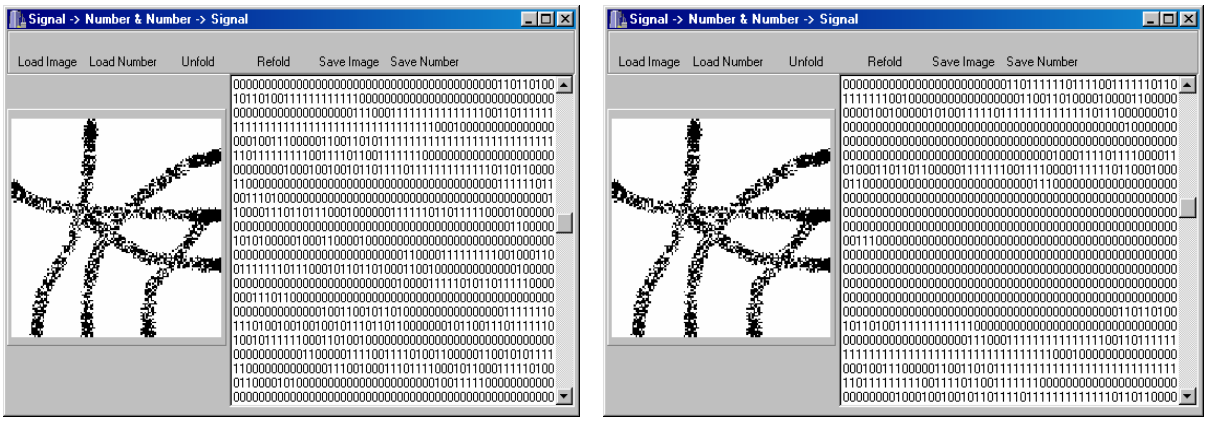

Fig. 4. *N-s and (N+1)-s steps of binary sequence of transport flow dynamics*

Hidden regularities are rules or algorithms permitting to restore pieces and, accordingly, to forecast stereotyped situations in transit corridors. The absence of regularity means complication of algorithm permitting to restore sequentially elongated initial pieces of an infinite succession. Here concept "complication" contacts to concept "organization".

The simulation and analysis of transport situations in transit corridors on the basis of an evaluation "amounts of legitimacies" by elongated initial pieces keeping in an infinite succession, allows making a following conclusion. The initial pieces, that is data fusion about a transport situation in region, will derivate a random succession of the snapshots and do not allow to forecasting the subsequent pieces of a binary succession. The random succession of the snapshots means, that, at first, there is a repeatability of the snapshots and, secondly, the random binary succession does not content to the tested laws of probability theory (law of major numbers, law of the iterated logarithm etc.). On the other hand, the chaotic succession of the frames characterizes composite system that is unorganized system.

3. Conclusions

1. The transit transport system is weakly organized system, which demands round-the-clock supervision and is unpredictable.
2. The self-organization of locomotion on transport corridors descends if there is the system of telecommunication.
3. The region provides telecommunication, supervision and service of a transport flow.

References

1. Milan Zeleny (ed.), The IEBM Handbook of Information Technology in Business, Thomson Learning, 2000.
2. Hassan Gomaa. Designing Concurrent, Distributed, and Real-time Application with UML. Addison-Wesley, Boston, 2000.