

Smart City and Digital Humanities

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1 ABSTRACT

This project presents an extension of a discussion of ideas related to the upcoming global digitization and the role and place of a person in the digital world. The digital environment of a human being and society was discussed in a number of papers and reports at scientific conferences, magazines and books. This work makes an attempt to determine possible forms of our future society based on an example of historical development of human society and taking into account growing digitization of all aspects of life.

CRISALIDE project (City Replicable and Integrated Smart Actions Leading Innovation to Develop Urban Economies) started in October 2018 and was one of the very few projects co-funded by EU and Russian Federation through the Horizon2020 programme and the ERA-NET RUS PLUS (ENRP) program. Participants of the CRISALIDE project were the following companies: SUPC Ltd. (Russian Federation), URBASOFIA (Romania), EMaTTech (Greece), SPIIRAS-HTR&DO Ltd. (Russian Federation) and CORP (Austria).

In the CRISALIDE project an Innovative Decision-Making Tool has been developed for Contributions on:

- Urban Information Systems and Decision Making
- Urban Decision Support Systems
- Geo-Information-Infrastructures, Data availability (Basemap, INSPIRE, Open Governmental Data et al.)
- Urban Planning context, participation

From our point of view a Digital City (DC) is a special terrain or a limited digital world from the one hand but from the other is unlimited as a part of a global information system of the Earth (WWW). This world (DC) contains a number of humans and many of them (not everybody) have their own HDS.

At the recent conference, CORP 2016, the idea about free space around a human has been discussed. In this paper we will provide some ideas to next generation of CRISALIDE with tide to humanity.

Keywords: Corporative Information Systems, Digital World, Human's Digital Space, Digital City, Digital Humanities

2 INTRODUCTION

In this paper, we would like to continue our research regarding human's digital space (HDS), smart city and CRISALIDE project, as a case study of our theoretical research. In previous research papers we have discussed different points of digitization such as: digital space, metrics of space and a metric for HDS properties. Metric plays important role for real work applications and an idea of Hausdorff measure (a special mathematical measure used to calculate length, area and volume of non-specific figures) discovers new opportunities for realisation of different kinds of business logics in complex multidimensional and implicitly specified spaces. For HDS, investigation the Hausdorff measure could be used as an approach for numerical interpretation of HDS properties.

Also a Corporative Information Systems idea has been selected as a main technological background for CRISALIDE project that can be used for decision making process tool for smart city investigation. As a rule the Corporative Information Systems (CIS) idea and tools are using for decision making support for rather big business companies. Such systems were introduced approximately twenty years ago and have shown good results for businesses optimization since and has many realization by software applications. The present-day demand is to move cities to a digital era. Considering this demand, CRISALIDE project was directed to digital city governance and management.

As well as a key technological instrument intelligent geographic information system IGIS was applied for visual and analytic 1D, 2D, 3D, 3D+t representations of geographical elements and others features of smart city. According to IGIS idea, a human also can be regarded as an object of GIS presentation and investigation for end users, software agents etc.

CIS approach based on proposed methodology provides means for development and support of decision making process for different levels of governance and management. Governance and management should not be centralized, it should be distributed with weak feedback links.

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We consider next extension of the CRISALIDE as an instrument for end users. And also we understand an up to date users as an existence that exist inside a specific medium or a space that can be defined as a human digital space (HDS), as a part of smart city digital space. Let us to make some remarks regarding of main existences by our approach (discussion).

3 HDS SPECIFICATIONS

It is very hard to image a DHS as a special physical space around a human. It is a deep abstraction that can be have only mathematical description. DHS contains differed sub spaces that can be presented as a system of ontologies. Some of them might have a digital expression:

- weather data in the vicinity of the point, in the area (2D or 3D) or on the route (data set and/or its interpretation);
- weather analytics (forecast) in the vicinity of the point, in the area (2D or 3D) or on the route;
- medical support in the vicinity of the point, in the area (2D or 3D) or on the route.

Other properties could have digital properties (for example geographical coordinates) and complex information for a human:

- digital networks support capabilities in the vicinity of the point, in the area (2D or 3D) or on the route;
- availability of different markets (food, everyday goods, etc.);
- police stations (offices);
- transport systems nodes (bus & railway stations, harbours, airports etc.)
- leisure venues;
- address and coordinates of hotels, pubs, etc.;
- banks & financial services.

Selected above properties show direct and relatively links between such existence as human and city. Most of them could be realized on computer and visually presented on a screen.

4 COMPUTER REPRESENTATION OF HDS

For computer representation of HDS we should introduce a IGIS system that includes the following main parts at minimum:

- map server;
- weather conditions server;
- business analytic server;
- 2D+t, 3D+t engines;

- artificial intelligence (AI) server;
- system of documents exchanging;
- client's applications (web, etc.), see Fig 1.

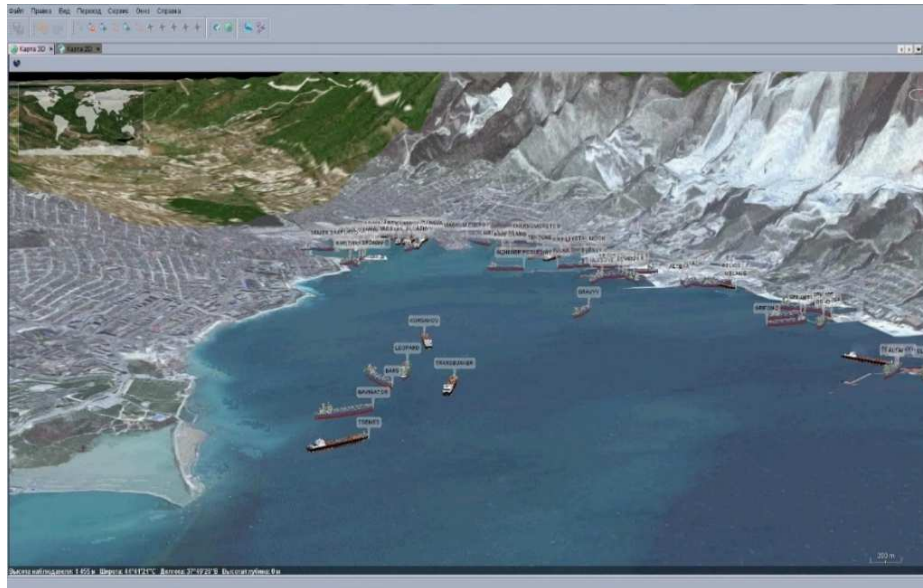


Fig. 1: A variant of end-user screen.

In this situation more important is not only a visual representation of HDS but its numerical estimation. In CRISALIDE projects there are a lot of numerical estimation of human spaces as is shown on Fig. 2.

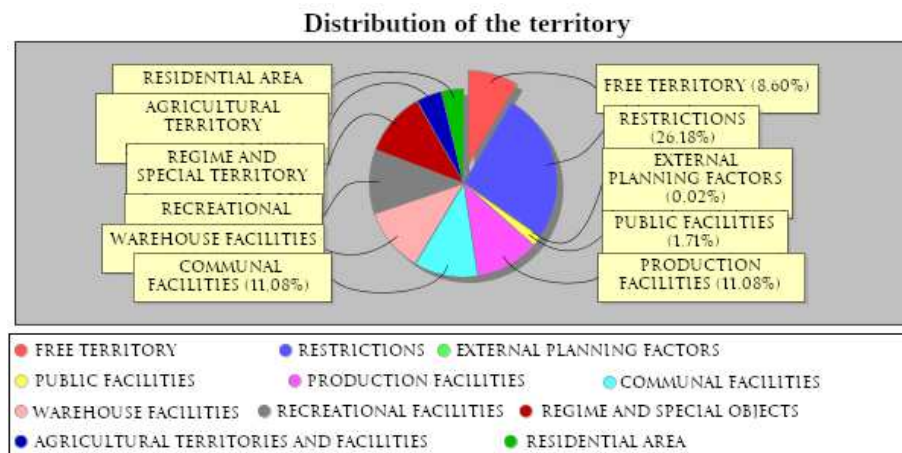


Fig. 2: City area distribution according to human demands.

Decision making support system (DMSS) can help CRISALIDE users to satisfy human's demand for space. But it is evident that data in Fig. 2 does not reflect even HDS properties. And it is a subject for research to detect and to study a functional dependence of HDS properties from the city area parameters shown in Fig. 2.

5 SMART CITY

Despite the evident fact that a modern city can not be described as an isolated entity, physically, citizens are living inside an abstract terrain. There are two worlds: a physical one and an informational one. And there is a big difference between them as well. The physical world is restricted and limited, informational one is unlimited and can not be restricted without special activities and devices. It is a new demand – a contradiction between two worlds: physical one and an informational one. The difference is getting bigger and bigger from year to year. In physical world everything inside a city is typical and suitable for human existence and nature. Informational world is another story. A city and a human are only some points (nodes) inside a global informational matrix. And a city is only a set of human's nodes that have only physical boundaries but without information limitations. In global informational matrix we have lost such useful and understanding phenomena (for human) like a distance and other geometric properties.

According to our description of human digital space it seems to us the city also has its own digital space together with physical space. But what is a digital space of the city (DSC)? From a technological point of view, a city has a complex information infrastructure (in computer science interpretation):

- supporting system (electricity, energy systems, etc);
- network systems (wired, wireless (GSM, wi-fi, Satellite, etc.);
- network nodes;
- data centers (back end systems);
- private and public front end devices.

Some remarks. During the process of the CRISALIDE project development we have paid main attention on a physical properties of the smart city. But human, as a key elements of the city, was described as a set of demands only but not as an existence for itself. And at this time we are consider that next evolution of CRISALIDE project should be pointed into human's direction.

In a current stage, the system of intelligent decision support for urban environment management (CRISALIDE) is designed to integrate decision-making processes in the field of creating urban strategic and territorial plans, the formation of urban policies, promotion of e-government, management of urban infrastructures and housing stock (facilities and utilities, regeneration of residential areas), retraining of production areas (renovation of ex-industrial zones, temporary use of empty buildings) and their development (science parks, incubators, network of clusters of small and medium-sized enterprises), as well as land use management in urban development areas.

CRISALIDE is a software and hardware complex based on intelligent GIS, which provides the ability to integrate maps of various formats, implement a scenario approach in urban development modelling, 3D modelling, support for 2D + t modelling, support for 3D + t modelling, support for decision-making based on expert knowledge, the ability to monitor changes and assess the possible impact of decisions on the urban environment.

The software and hardware complex provides the consumer with a universal set of technological and functional solutions within the framework of the basic configuration with the possibility of expanding functional tasks in accordance with the requirements of the customer and the subject area, multi-platform and the absence of mandatory additional paid software.

The main end users of the developed CRISALIDE system are state authorities and local self-government, public and private enterprises and organizations directly related to the functioning and development of the urban environment. The introduction of the CRISALIDE system allows us to solve the following tasks: to develop e-government, to improve the quality of public administration through the creation and implementation of modern information technologies. The proposed system of intellectual decision-making support makes it possible to predict the development of urban infrastructure both within the city as a whole and in selected districts and quarters, to identify a deficit or surplus of construction facilities and/or infrastructure, as well as to take into account the socio-economic aspects of the development of municipalities and regions.

Next generation of the CRISALIDE project by our opinion should be focused on the next main problems as follows:

5.1 Information and knowledge clouds of services for an individual development

Our company during recent years has been developing an artificial intelligence (AI) system of tools for decision making support for not trivial tasks as situation assessment and estimation, command and control circle realization, pattern recognitions etc. The AI systems consists of the following main parts: an ontology system, business process management (BPM) system, SVD engine for recognition of abstract and physical entities and objects. Our major idea is to create (automatically) individual information environment for ever human using AI tools. In other words, a private human's digital space (PHDS). The PHDS should aid individuals first of all in the routine of everyday life.

5.2 Private business analytics development

Scenario approach (BPM realisation) with application of SVD engine could help individuals to arrange everyday activities and make right decisions of local scale (to buy wine, fish or other goods, etc.) and up to global scale (to plan trips, to buy a house, etc.).

5.3 An intelligent social networks development

A main goal of such network is to share knowledge via the Internet. Regarding to our concept of information (measurement, data, information, knowledge and understanding) and knowledge representation and sharing (for free or paid, it depends on the specific case).

As one can see, the next generation of CRISALIDE should turn in human direction. And it can become a system or some set of services in current version of CRISALIDE or it can be a separate system similar to a typical social network. This question is under our investigation right now.

6 SYSTEM OF DEVICES

Every system of automatic or automation control has a simple structure, see Fig. 3.

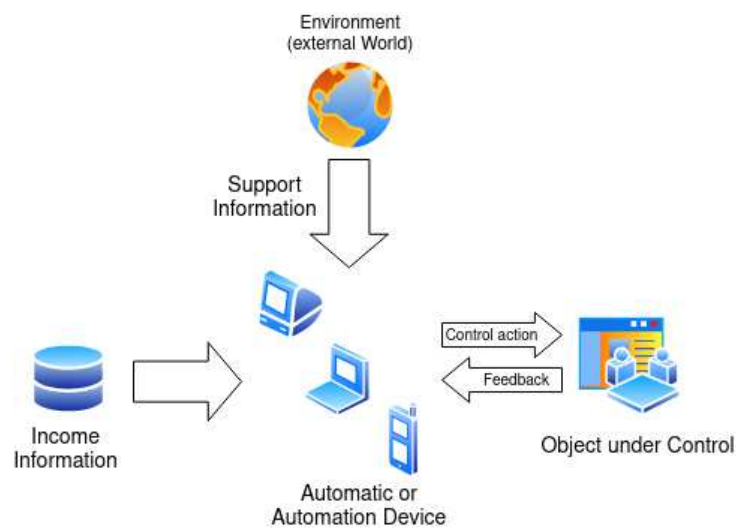


Fig. 3: System of automatic or automation control.

The difference between automatic or automation is that in first case there is a fully autonomous device and in the other case there is a human presence in the control process. Application of automation system in DMSS is justified only when control process can not be formalized by mathematical functions or equations. And a final decision could be made by human.

Let us pay attention to Fig 3. There are flows of information, at least two: income information and support information from environment.

6.1 Income information

This is a specific information (measurements, data, information) from sources that we require. Without this information the system of automation will not work properly. If such information is absent, it is difficult to count on the right decision. Access to such information can be carried out in many ways. Directly device to device, by wired system or by different wireless networks. In our days most of devices have special ports for connecting to wired or wireless systems. And they can communicate with each other by Internet. “Internet of things” is a common name for such opportunities. Devices for receiving such information could be: wi-fi devices, sell network gadgets, satellite receivers, etc.

6.2 Environment’s information

This is a supporting information that can directly or indirectly influence the decision making process. For example, weather conditions directly influence the decision to start a journey by car or by yacht. There are a lot of weather web-sites on the Internet but it is not easy to implement them for other applications. They are oriented on a human perception and interpretation. If you wish to obtain primary information it wont be easy

to do, as a rule. There is a wide spectrum of devices for obtaining such information. SPIIRAS-HTR&DO Ltd. also produces many devices for environment’s conditions measuring as is shown in the Table 1.





1	<p>Meteorological multisensors</p> 	<p>Measured parameters: relative humidity, atmospheric pressure, temperature. Data transfer via TCP/IP protocol.</p>
2	<p>Wireless sensors for measuring atmospheric parameters</p> 	<p>Measured parameters: relative humidity, atmospheric pressure, temperature. Data transmission over wireless networks: cellular, wi-fi.</p>
3	<p>Inertia-free wind measurement sensor</p> 	<p>Measured wind parameters: speed, direction.</p>
4	<p>Electromagnetic field meter</p> 	<p>Measured parameters of the electromagnetic field: frequency, level, etc.</p>

Table 1: Measuring devices.

The business marketplace for such devices is rather full. For example, Finnish company Vaisala had turnover in RF more than 13 million euros (2020) per year by weather devices producing.

6.3 Healthcare information

Healthcare information is includes two groups of information:

a) information from special devices for human health conditions estimation, such as heart rate, pulse, body temperature, blood pressure etc. Up to date devices such as iPhone, for example, include such devices. Moreover, a special software like “Watson” by IBM can make preliminary analysis of input data and automatically send information to medical emergency, hospital or doctor.

b) information regarding medical systems of the city or village depending on where a human is in a current situation. It helps to make a right decision if something happens. It can be received by different gadgets that have access to the Internet.

7 SYSTEM OF SERVICES

Main services can be presented by text, graphics and voice forms. A list of services is very big and covers all of city life routines. Most of the services are presented by Internet through different gadgets. But, as was noted by Erich Fromm, today people would like to know and can to do primitive operations, especially how to use gadgets, but do not wish to understand things. It is the biggest demand of our civilization. According to this evidently fact our proposal is to include in to a plan of CRISALIDE project next generation a systems of services, pointed to understanding process. So, understanding should be as a service from Internet.

8 CONCLUSION

As it was noted in the presented paper, the CRISALIDE project as an Innovative Decision-Making Tool has been developed for Contributions on

- Urban Information Systems and Decision Making
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- Geo-Information-Infrastructures, Data availability (Basemap, INSPIRE, Open Governmental Data, ...)
- Urban Planning context, participation

One can see that the main subject domain of our research was a Digital City as a special existence that has two sides: a limited digital world and a part of a global information system of the Earth (WWW).

The next generation of the CRISALIDE project will be consists next main parts as follows:

- (1) Knowledge clouds as services for individuals.
- (2) Private business analytics for understanding development.
- (3) An intelligent social networks development as a platform or environment for knowledge and understanding existences and processes.

Finally we should underline that the next generation of CRISALIDE should be turned in to a human direction.

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