Modeling of consolidated information resource for social data institutions

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Abstract. The importance of consolidated information resources development for social data institutions at the level of towns and establishments with a view to their further integration into national information resource is substantiated. "Smart city" projects portfolio is a new innovative model of the city, region and country development. A considerable part of the world cities and towns use the current innovation for project implementation providing their development with application of intellectual digital information – telecommunication networks and technologies. "Smart city" project implementation is encouraged by the world developed countries in order to rise living standards and economic growth of regions and cities. "Smart city" consolidated information recourse development is based on the application of modern information and communication technologies, tools design and operation algorithms and ways of polymodal information presentation and processing.

Key words: "Smart city" project, consolidated information recourse, library, museum, archive.

INTRODUCTION

New trends of applied scientific sociocommunications and innovative information-technological researches focused on the "Smart city" formation and growth are developed in the context of modern information society construction [1]. "Smart city" projects portfolio for each particular sociopolis are formed on the basis of this concept. Creation of effective management mechanisms, intellectual systems with diagnostics, service and control elements, statistic data processing, security and cybersecurity is involved throughout this project. "Smart city" projects portfolio is new innovative model of city, region and country development. A considerable amount of the world cities and towns use the current innovation for project implementation providing their development with application of intellectual digital information - telecommunication networks and technologies. "Smart city" project implementation is encouraged by the world developed countries in order to rise living standards and economic growth of regions and cities.

While carrying out scientific researches of the development of system innovative information-technological projects and programs, the need of sociocommunication compound creation for such projects arose. At present this trend has not got proper professional support and extension but system information-technological and social-communication researches focused on the development of convenient and comfortable sociocommunication environment of each city have considerably intensified.

The development of the "Smart city" information-intensive sociocommunication environment requires information-technological basis improvement to provide unique and specific information space for each particular city. Such sociocommunication environment is supposed to provide the residents and tourists with convenient information-technological tools to meet their information and communicative needs especially of socially-oriented character.

Social data institutions (libraries, archives, museums) as well as local mass media and information portals are the main components of qualitative sociocommunication environment of the modern city reflecting its mental specific feature. Such approach promotes the urgent and priority problem solution to rise effective information supply for city residents and guests. In practice it is appropriate to implement this by creating consolidated information resource virtually combining data recourses of libraries, museums, archives, mass media and other city social institutions. In the age of information society the role of such local consolidated recourse is to create social-cultural city space, to meet the information needs of the city residents and guests by providing wide as well as distant access to information recourses.

ANALYSIS OF THE LATEST RESEARCHES

The need of technological, economic and ecological changes arouse interest in "smart city" projects portfolio creation taking into account climate changes, economy restructuring, transition to Internet trade and delivery, availability of virtual entertaining services, population aging process, urban population growth and state funding situation. European Union (EU) regularly allocates funds for development of strategies of leading countries capital cities transformation into "Smart sociopolis" [2]. A set of programs within "Digital Europe Program" [3] with the focus on the growth of innovations and investments in the sphere of services for ICT development is created followed by promotion of state services quality

improvement and living standards rise. According to the previous estimates of ARUP agency [2], the global market of "smart municipal services" up to 2020 will constitute 400 bln $ USD per year [4].

A number of scientific papers by foreign and Ukrainian scientists deal with the conceptual foundations of libraries, museums and archives system interaction: W. Duff [5], P. Marti [6], T. Kirchhoff [7], A. Tammaro [8], M. Levy [9], N. Allen[10] and H. Gibson [11], S. Shemaieva [12]. This subject matter is annually discussed at International conferences organized by such prominent organizations as International Federation of Library Associations, European Library Automation Group, The Research Library Group, Rare Books and Manuscripts Section.

At the domestic level at different times specially organized governmental institutions were engaged in information recourses consolidation: in Britain - MLA - Museums, Libraries and Archives Council which in 2012 devolved its functions to Arts Council and The National Archives; Association of Italian Libraries (AIB), Association of Italian National Archieves (ANAI) and International museums Council (ICOM Italia) called MAB - Musei, Archivi, Biblioteche were initiated in Italy in 2011; in the USA in 2003 long-lasting cooperation of ALA - American Library Association and SAA - Society of American Archivists was broadened due to AAM - American Association of Museums affiliation; working group called LAMMS (Libraries, Archives, Museums, Monuments & Sites) was organized in 2009 under the authority of IFLA.

Portals of universal, state and regional importance providing virtual integration of information recourses from different sources are developed and succeed in their operation. As a rule such projects are focused on preservation of the world historical-cultural, art and other documentary heritage (World Digital Library [13], Europeana [14]) and their own country heritage (Deutsche digitale bibliothek [15], Lithuanian Cultural Heritage in the Virtual Environment [16], The British Library[17], and Electronic Library "Ukraine Culture" [18], etc.).They have both common and distinctive features in the way of providing the access to information, use of the standards of metadata electronic collection description, user interface creation, etc. Their operation is directed to attract wider range of recourses and provide free access to the wide range of customers but they do not take into account local historical-mental sociocommunicational context of regional and local information recourses of cultural and historical memory institutions. There are practically no researches the results of which prove the importance of the development and implementation of such consolidated recourses within formation of sociocommunication environment for certain cities. Methodological principles of consolidation of such mixed and polydocumentary information are not sufficiently clarified as well.

MATERIALS AND METHODS

"Smart city" consolidated information recourse development is based on the application of modern information and communication technologies, tools design and operation algorithms and ways of polymodal information presentation and processing. On the system output the end-user of such consolidated recourse receives information product containing information of various types given in unified form and predicts its use for processing and supply of special diverse hardware and software-algorithmic tools. At the same time saving of positive properties of traditional artifacts presentation, methods and forms of information transfer and display, maximum application of new possibilities of modern information technologies – interactive communication, retrieving and sorting according to the given criteria, mobile access to information recourses, integration with Internet network are provided.

Consolidated information recourse of the "Smart city" social data is presented as modern purposefully developed sociocommunocation system. Processes of sociocommunication system construction, design and creation using information technologies and sociocommunication approach implementing sociocommunication processes in modern information society are investigated by toolset of the new engineering theory – sociocommunication engineering, which rationale is determined by long-standing needs of the development of scientifically proven rules and principles of sociocommunication relationship formation in information society rapidly transforming into the society based on knowledge.

Definitely due to the toolset and definitions of sociocommunication engineering we define sociocommunication system features and consider the application of such approach to be important while modeling and designing of modern sociocommunication systems.

Sociocommunication engineering provides methods, means and ways for modeling, designing, development and construction of proper sociocommunication environment being the "Smart city" sociocommunication environment in particular. Such toolset makes it possible to investigate, analyze and fix certain principles of sociocommunication processes in information society for system analysis of methods, means and ways of information flow distribution and processing in sociocommunication systems.

As one of the new areas of engineering science sociocommunication engineering has its aim, subject and methods of research. Social communications and their components are aims of the research, design and construction of sociocommunication system and technologies are research subjects. Established methods used for sociocommunication system and technologies design and construction as well as general scientific especially system analysis are sociocommunication engineering research methods.

Methodological basis development of sociocommunication engineering predicts close collaboration of wide range of experts, especially in the field of information sciences, library science, document studies, sociology, journalism, computing, etc. Processes of effective sociocommunication system design should be based on application of system approach and system analysis methodology, modeling theory.

As far as organization peculiarities are concerned consolidated information recourse combining functions of electronic and digital library is the closest to virtual library as it is based mainly on digital document feeding but it is not bounded to any information storage location it operates. That is why while designing and modeling consolidated information recourse we based ourselves on general principles of multifunctional electronic library creation [19].

Let us define the main functions of modeled "Smart city" consolidated information recourse:

- to meet users information needs (urban society);
- to deliver information services: search according to different criteria, events announcement, information about new publications (scientific papers, historical explorations, etc.);
- to organize information effectively (cataloging and convenient navigation);
- to operate polymodel information: information delivery to users regardless to its origin, physical location and way of presentation;
- to provide integration and consolidation of information recourses in single access point.

To construct information model of consolidated information recourse we apply basic principle of structural analysis – decomposition principle in order to select "Consolidated information recourse" separate subsystems with their peculiar functions from complicated socoicommunication system.

While constructing functional diagram of consolidated information recourse according to IDEF0 notation we derive the following components of this information model (Fig.1):

- Model input data are meta data of information recourses (different by origin, submission and content);
- Output data are consolidated information product as query answer to the user); - Search requests setting rules are control data;
- Meta data exchange system and search indexing rules are recourses (mechanism) providing system operation.

General chart of the "entity-relationship" of consolidated information recourse is represented in Fig.2

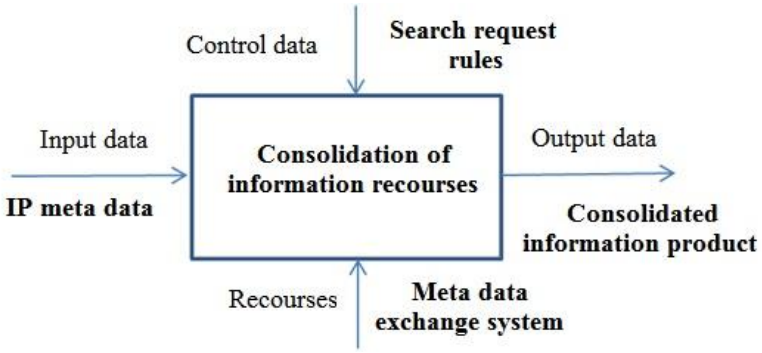

Fig.1. "Consolidated information recourses" functional diagram.

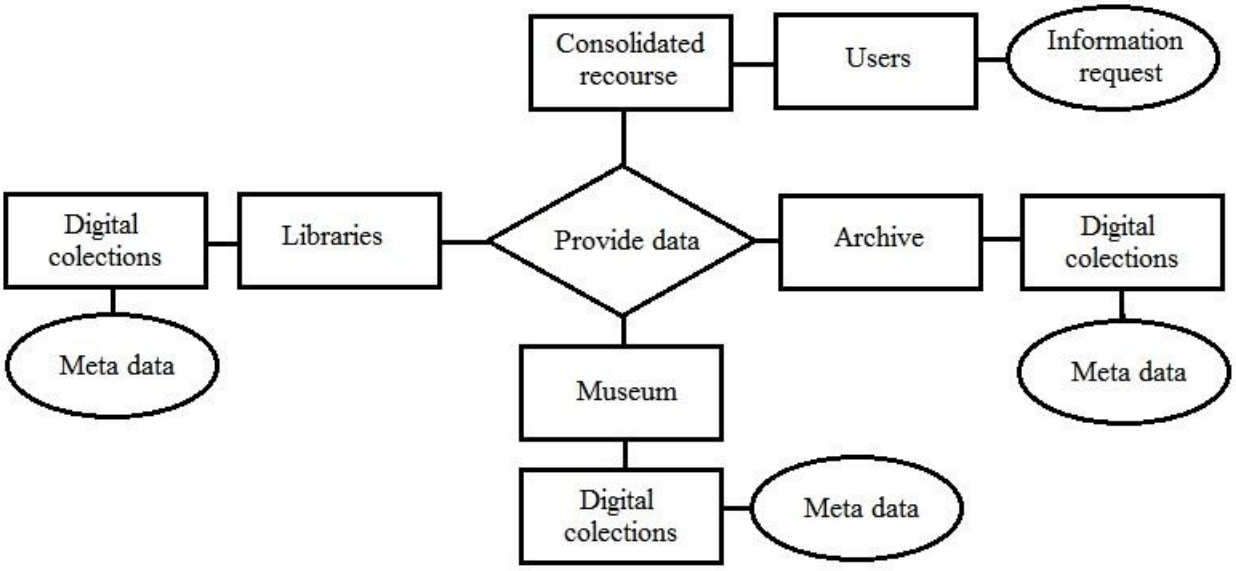

Fig.2. "Entity-relationship" diagram (ERD) of consolidated information recourse

The user interface of consolidated information recourse should be:

- *conceptual*, i.e. provide interface integrity for various recourses;
- *flexible* in granting access to necessary for the user information in different ways;
- *insightful* i.e. to provide simplicity of functions presentation;
- *interoperable* підтримувати i.e. to support possibility of interaction with other analogue projects;
- *expansional* i.e. to have possibility for further increase of functions and capabilities.

Modeling of consolidated information recourse will be carried out on the example of the small historical town Zboriv. Local archives, libraries and museums are data institutions preserving town cultural and intellectual heritage. They store records about certain people and community as a whole, about institutions and events, trades and education, traditions and innovations. That is why they attract interest of modern residents and tourists and their data can be useful for everybody – from curious pupil to scientist. Social data institutions should be the core of new digital sociocultural environment of cities, regions and territorial communities. Such institutions have their own unique spirit determined by regional, mental, historical specific character and that is why they have huge potential for the development and support of distinctive sociocommunication and cultural environment development comfortable for local residents and educational for tourists. For this purpose information model of the town sociocommunication environment containing consolidated information recourse is developed. In the course of investigations verbal model of designed consolidated information recourse is developed. This model has defined project problems:

- to carry out system analysis of current information systems;
- to develop recourse control principles;
- to determine recourse priorities;
- to determine recourse main components;
- to develop recourse information model;
- to develop recourse functional structure;
- to develop the model of search process in the information system model;
- to form the prototype of service-oriented information environment.

Such consolidated information recourse is considered by the authors to be modern sociocommunication system and information factory creating on the basis of its own and external information recourses a wide range of important consolidated information services and information products, providing information services complex for different categories of users.

On the first stage of our investigation the "Museum" information recourse subsystem is created. Consolidated information recourse contains the main records about institutions and electronic catalogues, meta data on these recourses and provides convenient search, distribution of functions between authorized users and average visitors, has considerable possibilities for administration. The use cases diagram in appendix B describes services which "Museum" subsystem provides to the visitor (actor). The use cases diagram represents abstract conceptual model of the "Museum" subsystem describing its functional purpose in the form of entities or actors interacting with the system due to so called use cases. The actor is supposed to be the visitor, system administrator, as they interact with the subsystem externally. Each use case is represented through the action set performed by the system on actor request. Generalization relationship is used on the diagram.

While modeling behavior of the designed system subsystem the processes of its state changes and peculiarities of operation performance algorithms are analyzed.

All services of the "Museum" subsystem are determined on use cases diagram (Fig.3).

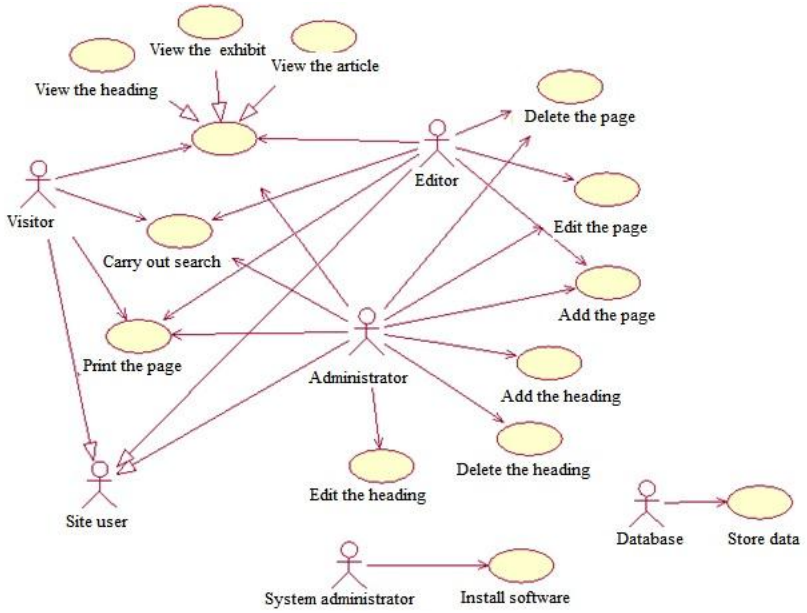

Fig.3. Use cases diagram

Each subsystem state is given as the performance of certain elementary operation, its completion allows transition to the following state. Therefore the diagram of the "Museum" subsystem activity is given in the form of graph. Its nodes are action states and graph arcs represent transition from one state to another (Fig.4). It is obvious from the specified activity graph that after the visitor reference to the site activity parallelization on several flows takes place. The first one provides page printing, the second one performs the search. Upon completion the operation of page addition, its delete or editing is initiated.

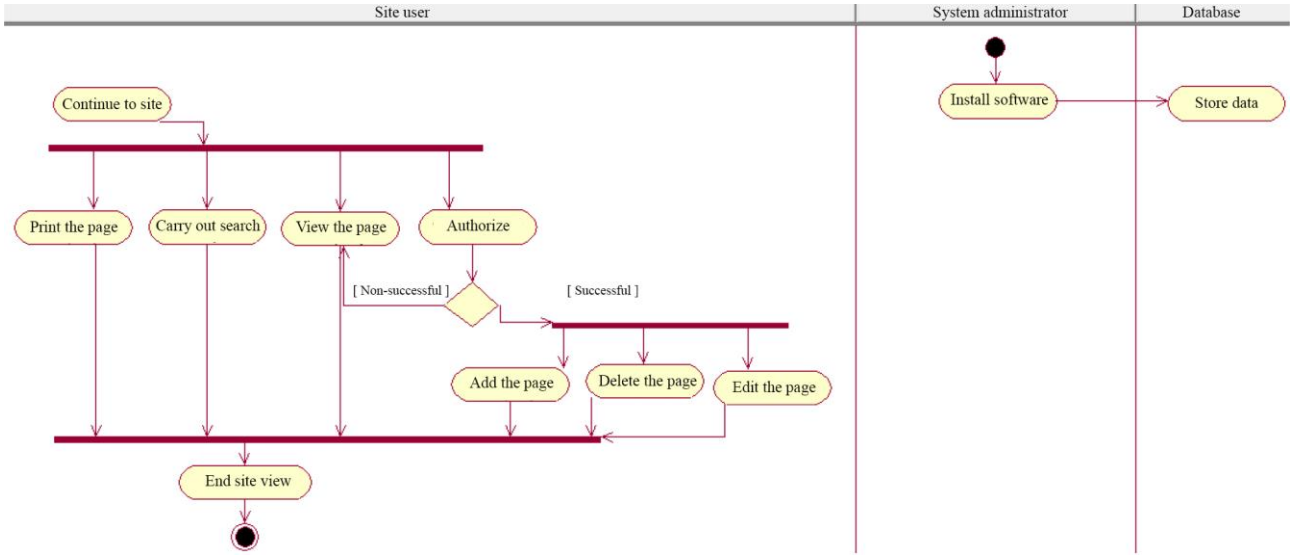

Fig.4. Activity diagram

RESULTS AND DISCUSSIONS

In order to implement the tasks of the development of methodological principles of the "Smart city" sociocommunication space the following investigations were carried out:

- complex analysis of the world experience of information recourses integration for social data institutions (libraries, archives, museums), as well as backgrounds, advantages and disadvantages of such integration was carried out [20];
- a variety of successful world Internet-portals consolidating information from the funds of the above mentioned institutions were analyzed, comparison of their functional possibilities, sources of information content, the ways of various information recourses consolidation was carried out, problems of their implementation were clarified;
- possibilities of providing interrelation between various information sources through meta data exchange system were investigated, standards set describing digital historical-cultural objects widely used in social institutions practice in different countries was analyzed, due to comparative analyses of the objects functional capabilities, conclusions about the most efficient standard of meta data description for the "Smart city" consolidated information recourse are made;
- the notion of "socoicommunication engineering" as the system forming kind of social and information engineering providing methodological basis and tools for design and development of modern sociocommunication systems in particular and the "Smart city" sociocommunication space in whole was introduced;
- prototype of the 'Museum" subsystem of consolidated information recourse system.

CONCLUSIONS

Modern approaches to the "Smart city' projects development generate the need of city sociocommunication environment creation taking into account peculiarities of the urban infrastructure, the need to implement innovative approaches and intellectual solutions.

Sociocommunication projects on information recourses consolidation for social data institutions of small towns with methodological principles developed on the example of Zboriv town are intended to provide social data storage within towns (communities, regions) with their further integration into nation-wide information recourse.

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