

Management and Information Processing at Virtual Museum

Sajarwo Anggai^{#1}, Ivan Stanislavovich Blekanov^{#2}, Sergei Lvovich Sergeev^{#3}

[#]*Applied Mathematics and Control Processes, St. Petersburg State University
7-9 Universitetskaya Naberezhnaya, St. Petersburg, 199034, Russian Federation*

¹sajarwo@gmail.com

²i.blekanov@gmail.com

³slsergeev@yandex.ru

Abstract— Almost every country have their own museum and standard procedure with different characteristics based on their state policies. In Indonesia itself until now, there are approximately 300 museum institutions. There are many problems currently faced by the museums include the management and processing data collection either structured or unstructured inside the institutions. Therefore, this research was undertaken in processing and managing data in the museum institutions in order to be delivered to the public based on customized information they need. Virtual museum as instrumental for supporting the achievement of the museum functions as a whole and using social media to campaign collections, broadcast contents based on their location, communicating with visitor, attract and influence society, exchange information and waiting for their feedback from user perspective to improve public services. Virtual museum as a complex system delivering an information to the user to answer necessary services for internal and external uses. In our investigation, virtual museum should know, determining, providing information based on visitors characteristics, behaviours and desires. In this case we assume that right information is not enough, therefore system need to process once more time the information to become closest information for the visitors. We have investigated Museum of Geology, National Museum in Indonesia, Hermitage Museum in Russia, and for balancing we also observe online resources provided by Louvre Museum in France and Virtual Museum of Canada. Our result is a design of virtual museum engine which can obtain relevant information based on visitor characteristics, behaviours and desires through variety of media.

Keywords— museum, management, processing, collection, information

I. INTRODUCTION

Almost every country have their own museum and standard procedure with different characteristics based on their state policies. In Indonesia itself until now, there are approximately 300 museum institutions under Ministry of Education and Culture (MOEC), Republic of Indonesia (RI) and Private Corporation. The government state about *Gerakan Nasional Cinta Museum* (GNCM) or national movement of museum lover, through Visit Museum Year (2010-2014) program. GNCM intend to strengthen three main pillars of the museum in Indonesia, namely 1) educating the nation, 2) forming

personality (character) of the nation, and 3) embed the concept of national resilience and insight archipelago [1].

According to the International Council of Museum (ICOM) statutes, adopted during the 21st General Conference in Vienna, Austria, in 2007: A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment [2].

Museum architecture as the art of designing and building a space that will be used to house specific museum functions, more particularly the functions of exhibition and display, preventive and remedial active conservation, study, management, and receiving visitors. Museum buildings was often focused on safeguarding collections, even they created storage areas by creating space in the basement, or by building new structures [1]. In other word, museum is the only place to store the collections and not at all of museum's collections were displayed.

There are many problems currently faced by the museums include the management and processing data collection either structured or unstructured inside the institutions. Therefore, this research was undertaken in processing and managing data in the museum institutions in order to be delivered to the public based on customized information they need.

II. RESEARCH OBJECTIVE

The purpose of this research are to identifying, investigating the real problem in physical and management at museums, how they spread information in digital era and how to design a virtual museum system in retrieving information from structure and unstructured data related to the collections information.

III. INVESTIGATION

For strengthening our research, currently we have investigated Museum of Geology, National Museum in Indonesia has a total collections more than 141.899 items, consists of seven types of collections are prehistoric, archeology, ceramics, numismatik-heraldic, history, ethno-

graphy and geography [3], Hermitage Museum in Russia, and for balancing we also observe online resources provided by Louvre Museum in France and Virtual Museum of Canada (VMC) to enhance Canadians' knowledge, understanding and appreciation of events, experiences, people and objects that reflect and have shaped Canada's history and identity. VMC providing more than 500 virtual exhibits promoting the content of Canadian museums, 150 interactive resources, over 365 learning resources including lesson plans and educational activities. VMC content provided by many collaborator approximately 1,600 museums [4].

We have founded many problems at the museum institutions, which are classifying as the following:

A. Physical

Museum institution in general providing physical access to museum environment and it resource as a part of public services, but in our investigation there are lack of the physical museum, they are:

- Time limitation, visitation to the museum is limited to the visitors.
- Distance limitations, visitor could not be attending to the museum because too far away from their hometown, separated by island, country or continent.
- Space limitation for exhibition, therefore not all collections displayed at the exhibition room, and they put the collections on storage area.
- Museum with many rooms will make visitor confuse, and sometime visitor do not want to see a specific collection because of phobia or not meet with visitor desire.
- Collections information provided by museum institution usually are not detail, therefore visitors do not understand the collection he saw and did not enjoy his visit.
- Communication among visitors were not happened, at the end it happen only from guide to visitor or vice versa.
- Not all people know the existence of museums and their object collections.

B. Management

Management in museum have been facing many problem as follows:

- Museum institution have big object data collections, some of them still on process to classify and identify by researcher.
- Data in the museums were separated and become hard to maintain.
- Object collections can be lose or broken because of natural disasters (force majeure).
- Lack of museum publicity, imaging, promotion and service include informing an event will providing by the museum institution.
- Community, observer and lover of museum has not been established. Even the government state about National Movement of Museum Lover, through Visit Museum Year (2010-2014).

- Implementation and management of the museum is not in line with recent development of information technology.
- Online information, some of the museum have websites, but they are limited and only provide information about the museum institution and not the object collections.
- Information for tourism or researcher from other country still not provided by museum institution.
- Route and destination for best way to visit the place still not established yet. Route and destination information are very important for tourist and local to find the best way, reducing cost and time.
- Mobile technology with virtual guide still focus on highlight catalogue, news, and floor plan, but they forget to provide floor plan with direction to each room which providing collection information that meet with visitors desire.

IV. CONCEPT AND DESIGN

In general museum institutions have many data and information of object collections, some of them have a complete documentation and the other just a half or even minor of information. The collections usually displayed at exhibition room and the other at storage area with full access or restricted. Museum visitor visiting museum, observing the collection and back to home with or without information.

Museum visitors come to see and observe a variety of collections that were displayed by museum, but what they see perhaps not necessary meet with their criteria, desires and preferences of the visitors itself.

Until now, museum institution for providing public services try to attract visitors with developing audio-visual, make visitors comfortable to surfing and searching information of the collections and exhibition through their website with 2D or 3D visualization as shown in Fig. 1.

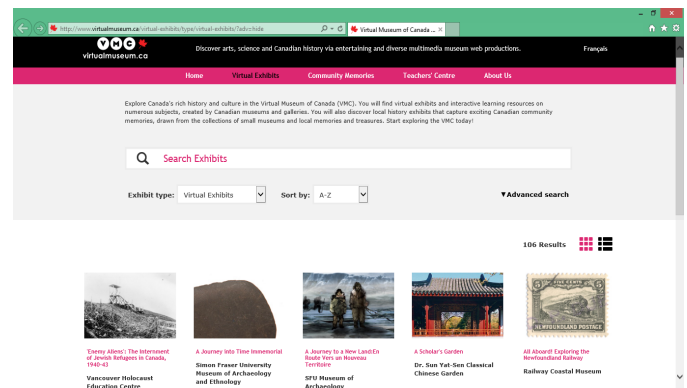


Fig. 1 Website of Virtual Museum of Canada providing exhibition in cyber space.

Information delivered through website as in Fig. 1 focus on one subject exhibited and VMC website also providing services for searching collection information, but unfortunately when visitor found a collection, the system only

describing about the collection itself and not related to similar collection inside 1,600 museums managed by VMC.

While VMC providing information through website, Hermitage Museum in Saint Petersburg, Russia providing application in mobile devices as a guide for the visitor in 5 languages, include floor plan, news, collection and catalogue as shown in Fig. 2.



Fig. 2 Mobile Application provided by Tour Bureau of the Hermitage Museum, Saint Petersburg - Russia.

Museum of Geology and National Museum are providing website but just for general information and not focused on exhibition and collection. In Museum Geology we have founded many data related to the collection and they try to documenting, recreate numbering system for each object, some of collection information indeed not discovered yet (researcher still working to identify the object collections), and the other information still based on old paper report. Recently they managing all collections in exhibition room and storage area and saving the information inside internal database application as shown in Fig. 3.

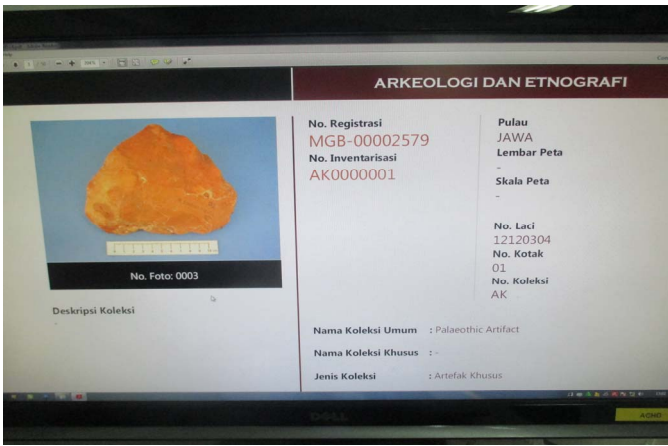


Fig. 3 Collection databases for internal management in Museum of Geology, Indonesia.

National Museum official website providing eye catching collections not more than 100 collections, and if visitors want to see the collections have been displaying in National Museum through website, of course they will not find all collections including those in storage area. The other featured collections they put on Google Art Project website to promote the artwork as shown in Fig. 4.

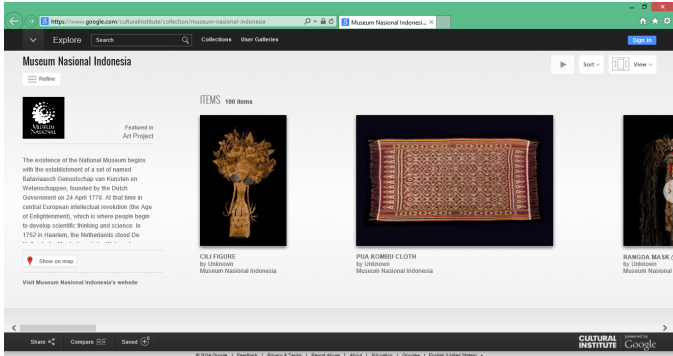


Fig. 4 National Museum program for promoting artwork through Google Art project website.

The information system between Museum of Geology and Museum National are not connected include featured collections in Google Art, therefore there is no linkage information on the collections of both institutions despite the fact that there is a closely interconnected collections information in both institutions.

In this situation and condition, museum institutions in Indonesia must be find alternative solution for solving the problems both in the exhibits and collections. One proposing solution in digital age is developing Virtual Museum in Indonesia as instrumental for supporting the achievement of the museum functions as a whole and using social media to campaign collections, broadcast contents based on their location, communicating with visitor, attract and influence society, exchange information and waiting for their feedback from user perspective to improve public services. According to Steve Dietz, et al, in the book The Next Generation of Virtual Museum include: integrated with social media to share experiences and knowledge [5].

The design of system also cover cyber exhibition program, and linked with source of collection information in each museum institutions both internal and external uses. Lia Laela in her thesis stated that cyber exhibition developed as a complement of the exhibition held in the real museum, not as a replacement. The system had tested to the several users and the results show that users get different and more interactive experiences and detailed information compared to what they get when visiting the physical museum. The cyber exhibition also add values to the collections, therefore they become more meaningful [6]. Virtual museum designed as a part of the future of museum that integrates with social networking in the process of collection and dissemination of information supporting the existence of good communication between the visitors and trustees of the museum in cyberspace. The future of museum provide a personalized learning environment to support learning process [7].

Virtual museum system will be providing easy way to conduct learning process through cyber exhibition, whatever topics related to the collections will be presented to the user as possible. Learning process at cyber exhibition will be automatically happening when the visitors accessing the virtual museum system. The system will providing right information and also showing related information for assisting

visitors to explore into deep substance of the information. Yeni in her paper try to integrate discovery-learning method into virtual museum. There were increased cognitive learning outcomes after students learning through discovery-learning method. This is the early start to realize virtual museum as the concept development of future museum [8].

Smart system in virtual museum will automatic adapting, record all user activity, perceptions and responses as part user experience before, during and after used virtual museum services. This feature is an important part to ensure and determine how the system retrieving closely information from data source to the visitor. Ratri stated that problem related to interactivity is a lack source of the visitors' learning experience. The teaching learning process conducted in museums generally covers listening, visualization, or visualization and listening area. One of the ways to handle the problems is to develop web based virtual museum because it will increase student's motivation and could be accesses wherever and whenever as long as computers and internet connection are available [9]. The system will be designed to understand user, and meet with their expectation through data visualization in variety perspective.

Each collection in museum institutions have structure and unstructured data source. This data sources increase day by day and become hard to maintain, therefore necessary to develop a system for extracting and processing data sources until become important information and useful for visitors as shown in Fig. 5.

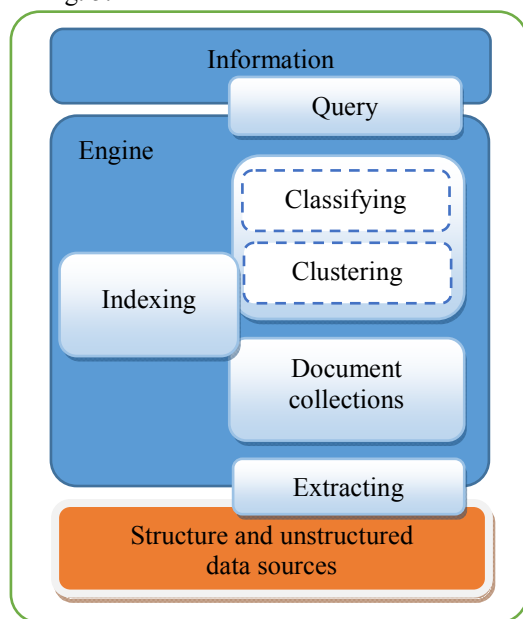


Fig. 5 How virtual museum engine extracting structure and unstructured data source to become important and relevant information.

In Fig. 5 show how virtual museum engine working to extracting and obtain relevant information from data sources. The activity to retrieving information usually called information retrieval (IR). IR is finding material (usually documents) of an unstructured nature (usually text) that satisfies an information need from within large collections (usually stored on computers) [10].

System will be designing to understand structure data in current database or semantically tagged of museum institutions where they used to store collections information, and system also support to manage unstructured data that have not define data-model or semantic. Result of extraction process are document collections which every document have unique numbering as identity (trough tokenizing process) before engine continue to the next step. For identifying language of the document we will prepare terms dictionary include stemming algorithm especially for Indonesian language (common language have been using as primary language of the resources that have been collected) to reducing term size. We will also preparing some algorithm for constructing static and dynamic index with compression in order to less disk space.

The system create classification for routing, filtering and segmenting, while clustering will be useful in grouping documents, because of this feature collections information are displaying to the visitor will automatically be closely linked with other collections. User interaction to the system also need to be translated into query with optimization in order to precise result of information needed. The system will formulate source of information therefore visitors can understand the object collections by providing detailed information and relevant to the object. Thus, visitors not only enjoy the view of the object but rather get a complete understanding. System that has integrated help of the mnemonic to the user in understanding the activity within the meaning of the value contained in an object of collection in virtual museum.

The benefit of applying method to retrieve information in museum for researchers are helping and assisting them by providing relevant information to the object of research in uncovering the meaning either before or after a visit to the stored object of collection in museum. Recent technology providing easy access to the source of information, therefore visitors can use a variety of media to access information residing in a virtual museum system as shown in Fig. 6.

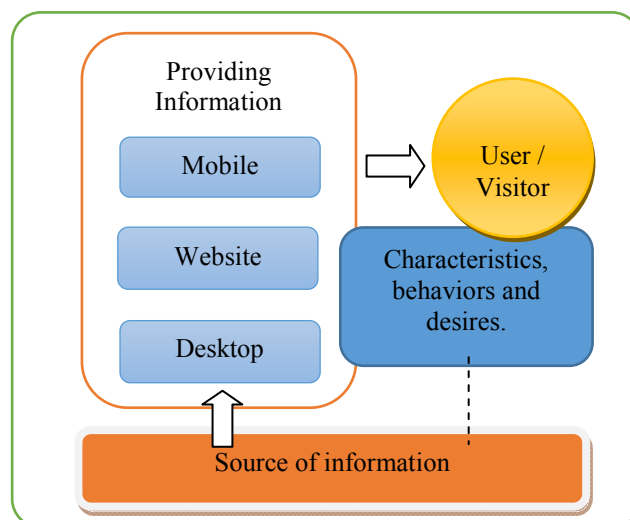


Fig. 6 Visitor accessing source of information through variety of media which meet with their characteristics, behaviours and desires.

In Fig. 6 virtual museum as a complex system delivering an information to the user to answer necessary services for internal and external uses. In our investigation, virtual museum should know, determining, providing information based on visitors characteristics, behaviours and desires. Retrieving information for each collection and combining with user characteristics is need big resources, therefore we want to combine some algorithms in determining which one the best algorithm to solve the problem. This engine of virtual museum also could be uses as complement of teaching and learning onsite or through the distance where are visitor really know what they need to learn based on the materials and sources of collection information.

Task to provide information access will be handling by engine as a core system inside virtual museum. This engine have two tasks, first task is processing old to recently data sources in museum institutions as shown in Fig. 5, and the second is handling users direct request to the information of collection itself, processing and delivering information need based on user characteristics, and acting as a real-time guidance as shown in Fig.6. The virtual museum system not only processing data sources to become important information, but also attracting visitors to the interesting places and give the right information of collections. In this case we assume that right information is not enough, therefore system need to process once more time the information to become closest information for the visitors.

V. CONCLUSION AND FUTURE WORK

In this paper, we have investigated Museum of Geology, National Museum in Indonesia, Hermitage Museum in Russia, and for balancing we also observe online resources provided by Louvre Museum in France and Virtual Museum of Canada. Our result is a design of virtual museum engine which can obtain relevant information based on visitor characteristics, behaviours and desires through variety of media.

We intend to continue this work and develop a method for complements: the next generation of museum, cyber or virtual museum in the world. We also planning to improve this research to become a smart system which can be used in various areas for analyzing, processing, retrieving and delivering information.

ACKNOWLEDGMENT

The authors would like to thank Dr. Gatot Hari Priowirjanto for his help and supporting this research, Dr.Tech Ary Setijadi Prihatmanto for her suggestion and direction, Mr. Makmur for providing data in Museum of Geology.

This work is supported by Department Technology of Programming, Applied Mathematics Control and Processes Faculty, Saint Petersburg State University, Southeast Asian Ministers of Education Organization Regional Open Learning Centre, Beasiswa Unggulan, Ministry of Education and Culture Republic of Indonesia.

REFERENCES

- [1] A. A. Munandar, A. Perdana, A. Rahayu, A. M. Gultom, D. Susantio, L. Asiarto, N. Supardi, R. Tjahjopurnomo and Y. Arbi, *Sejarah Permuseuman di Indonesia*, 1st ed., Jakarta: Direktorat Permuseuman, 2011.
- [2] A. Desvallées and F. Mairesse, "Key Concept of Museology, International Council of Museum (ICOM)", Paris: Armand Colin, 2010.
- [3] (2014) National Museum of Indonesia website. [Online]. Available: <http://www.museumnasional.or.id/>
- [4] (2014) The Virtual Museum of Canada website. [Online]. Available: <http://www.virtualmuseum.ca/>
- [5] S. Dietz et al, *Virtual Museum of Canada: The Next Generation*, Canada: Canadian Heritage Information Network, 2004.
- [6] L. L. Sarah, The design and implementation discovery learning method on virtual museum of Indonesia:(A case study museum of geology for rock materials), Bandung: IEEE Xplore, International Conference on System Engineering and Technology (ICSET), 2012.
- [7] S. Anggai, The Design and Implementation of Social Networking at Virtual Museum of Indonesia (A Case Study Museum of Geology), Bandung: Institut Teknologi Bandung, 2012.
- [8] Y. Nurhasanah, The design and implementation determining age of fossils game simulation at virtual museum of Indonesia (A case study at a Museum of Geology), Bandung: IEEE Xplore, International Conference on System Engineering and Technology (ICSET), 2012.
- [9] R. D. Kayungyun, Design and implementation of interactive cyber exhibition on virtual museum of Indonesia, Bandung: IEEE Xplore, International Conference on System Engineering and Technology (ICSET), 2012.
- [10] C.D. Manning, P. Raghavan, H. Schütze, *An Introduction to Information Retrieval*, England: Cambridge UP, 2009.