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Ivana Zorić
Nikola Tesla Museum
Belgrade

PROCESSING OF DOCUMENTS AND DIGITIZATION OF PHOTOGRAPHS FROM NIKOLA TESLA'S PERSONAL FUND

Abstract. The work presents methods and results of processing and digitization of Tesla`s photographs undertaken in order to systematize the data they're containing in the best possible way, as well as to provide them protection and make them available to the wider circuit of users.

Due to specific and unique nature of materials, techniques and various templates, although registered as archive subject matter, photo materials from Nikola Tesla`s Personal fund presents, according to many parameters, an individual group and demand a special treatment in means of description and preservation. This task is highly important, especially considering that UNESCO has, in 2003, enlisted Tesla`s Archives into the register "Memory of the World", which is the highest form of preserving the cultural heritage.

The project of digitization considered choosing the methods of digitization, hardware support, digital formats, data storage media and ways of protection of digital data, as well as creating a relation database organized in such manner to make it possible to explicitly identify, locate, label and describe each photograph, but also to record data of its museum "life". The computer application Tesla_Photo has been produced, made in order to enable an efficient search of all available digital records and information on photographs, as well as efficient realization, recording, filing and tracking of external and internal demands for the use of the materials.

Objective point of the processes of digitization in the Nikola Tesla Museum, apart from protecting of the materials, is to make a unique information system to join all museum collections.

Photography ("writing with light" or "painting with light"), is a process of permanent recording of picture on film or other light sensitive material by projecting light through camera lens. Photograph is a picture made in the same way and printed, usually on paper.

Tesla has participated in creating a part of history of science development, but he also showed interest and accepted novelties in technological developments of other areas in his time. The photographs from Nikola Tesla's Personal legacy are very interesting from the aspect of development of photography and photographic techniques and show a little history of development of this media.

The photo materials from Tesla's legacy are classified as a part of Tesla's archive and further divided, according to media, into photographs, photo panels and slides. These photo materials mainly show Tesla's inventions and laboratories. Especially interesting are those of Tesla himself, of his relatives, friends and other persons important in his life and work.

Within the fund which is a part of Tesla's Personal legacy is kept a total of:

- 976 photographs
- 270 photo panels
- 172 slides.

Processing of photographs from Nikola Tesla's personal legacy – museum documentation

We consider a museum item to be both a source of information and data carrier. The process of communication between an expert and an item depends upon a person's knowledge

and capability to discover and acknowledge information regarding the item and to try to record them and transfer information onto conventional data carriers. This process creates a database that will satisfy the needs of most the potential users. Thanks to the development of computer technology today, it's possible to have a computer database and digital copy of museum items and keep them safe in a controlled environment of museum warehouse.

The goal of museum documentation is to explicitly identify, locate, label and describe a certain museum item, but also to record data of its museum "life".

The museum documentation about Tesla's photo materials has four groups of data:

1. Identification data. These data refer to the institution that keeps the photographs, name of the group, precise location and place of keeping and unique label of photograph.

2. Description. The second group informs of physical and content description of the photograph. These data are: type and name of the subject, materials and techniques of making, information of the physical condition of photograph, possible damages and recommendations for conservation and restoration and verbal description of appearance of the photograph, information of original subscription or label on the photograph and date and place of photographing.

The description of the content of a photograph is very important as it is actually information of what is shown on the photograph. Descriptions must rest upon reliable sources. The most competent descriptions are considered those written by Tesla himself, most often in notes for articles he published, or on photographs, as well as dedications and inscriptions on photographs he received from his relatives and friends. Apart form this source also are used captions previously published or used in exhibitions, with specification of the source. Such process of description of photographs has not yet been completed since there is, for some photographs, no reliable information and sources which would help identify persons, events or places photographed. It further remains to research different museum material to describe as many photographs as possible.

Information of the physical condition of a photograph and possible damages also consider recommendations for conservation and restoration.

3. History data. They refer to origins of photograph as an object: author, place and date of making, as well as purpose of making, its function, which mainly is of a documentary character.

4. Documentation references. This information refers to processing of objects in the museum, its use and display. Metadata on museum documentation of the photograph and copies made, processing and authors of copies of the documentation are kept.

Digitization of photographs from Nikola Tesla's personal fund

The digitization is the process of transforming information from the analogue to the digital form which can be managed by computer and can be reproduced by output devices, such as monitors and printers. It does not only imply scanning processes, but also the process of developing databases and information systems, their mutual connection and presentation by means of multimedia presentations.

Thanks to digital copies the possibility to access materials and demonstrate them increases, as well as efficient organization of data together with digital images and their storage, thus creating a larger possibility to keep, search and present science and cultural heritage to broader public, professionals and scientists.

The digitization of museum items or documents must be preceded by a general design which must contain the following:

a) Goals and scope of the project
b) Choice of funds to be digitized
c) Relation base project and ways of connecting digital photographs with base
d) Choice of proper hardware support (scanners, digital camera, computers)
e) Ways of protection of digitized data (making of backup copies, their dislocation to at least two different sites…)

Actual demands for starting digitization process depend upon objectives, expected results and end-users. Digital records can be used to identify contents and display on a screen and WWW, or for storage, publishing or exhibit activities…

The choice of hardware support is also stipulated by wanted outcomes of digitization processes, but most often depends upon technical development and financial power. It is necessary to choose between scanning and making digital photograph. The best way to make such choice is to test both options, if possible, and study the quality of both results, as well as observe limitations of both options and adopt positive experiences from practice of other institutions on similar projects. It is necessary to use computer whose performances (working memory and hard disk size) enable manipulation of large quantities of information.

When such decisions are made, it is then time to choose an adequate digital format, that is, level of compression. It is necessary to choose resolution appropriate for two purposes:

a) high quality copy for permanent storage
b) copy for frequent display and everyday fast access

Formats that do not compress image, such as "tiff" (or "row" in case of digital photographs), are suitable for reproduction and storage purposes but use more storage place and are not suitable for manipulating. They are used for master copies. Formats with larger compression compress the image in such a way that part of information and image quality are receded but the file size gets reduced. The most often used format is jpeg. The desired resolution (dpi – dots per inch) also affects the file size and image quality.

In order to obtain the highest degree of similarity to the original, digital images kept as backup copies must not undergo any interventions to original appearance of image. If it nonetheless has to be done, for publishing needs for example, all processing should be done on separate copies made for such purposes.

Storage media for images and data are most commonly computer hard disks, from which data are copied on CDs or DVDs in at least two copies which must be kept at different sites and properly indexed.

Scanning and photographing

As a part of museum archive records photo materials have been microfilmed in 2001. The developed microfilms have been digitized using the microfilm scanner Canon 500, in resolution 200 dpi in tiff format. Microfilm scans are at best of black and white photocopy quality and cannot be used for printing. Due to this and special importance of Tesla's photographs in the year when the 150th anniversary since his birth was celebrated, it was decided to systematically digitize the entire group and to shift from the concept of digitization the microfilmed materials to the concept of microfilming of the digitized, at the same time defining the primary roles:

1) Microfilms that have protective character
2) Digitized materials – that have using character

The digitized material is transferred onto microfilm in two copies.

According to demands and needs, the scanning and photographing procedures were defined. Due to technical limitations (scanner the museum owned at the time), only photographs

smaller than A4 format were scanned, while larger ones were photographed with digital camera. Area larger than the surface of the photograph was scanned in order to show all the edges of the photograph. All photographed and scanned photographs were attached with paper identification tape with museum logo and signature label of the photograph. In such a way all potential identification errors due to the latter scan handlings were avoided. Digital cameras with high quality optical performances were used for photographing, as well as appropriate lighting adequately powered to provide homogenous light field in the photographing zone.

Photographs are scanned in two resolutions (300 and 1200 dpi) in order to cover the largest possible number of uses. Scans are kept in tiff format on DVDs (master copies) in two copies and compressed into jpeg format installed at computer hard disc. Upon occasion of photographing raw format and maximum resolution was used (at the time of shooting 12 mega pixels).

Scanning and photographing was done systematically, according to the classification subgroups and records were kept very precisely. The reverse sides of the photographs were also scanned if there was any content.

Unique file denomination, storing and keeping was established in order to have accurate control over digital images.

The digitization process was actually never finished, since it demands constant maintenance. There is no long termed strategy that would ensure readability and usability of records in the future. The updating strategy of moving the digital records onto new digital formats and media nevertheless gives the best results.

Database and application *TESLA_PHOTO*

At the same time when scanning and photographing materials, new relation database was designed. Data from the existing database used for scanning with microfilms were transferred to the new database. The existing data were organized adequately and new important available data were attached. Information on types of digital images that are kept for correspondent photograph was also attached.

The database was created with an idea to formulate the museum documentation in a way which is the most convenient for database view. A database collects data relating to:

- Photographs – tables keeping all information on photographs as objects.
- Classification – tables determining classification subgroups and enabling connection of photographs to their belonging groups.
- Tables relating to digital images – connecting digital images to photographs and keep records on file names, formats, resolution, location where digital images are stored…
- Tables relating to captions – descriptions of the contents of photographs with caption text and information on the source and language the description is written in.
- Tables relating to the user accessing the application, but also users to which materials are granted for use in form of digital copies
- Requests - tables keeping records of outward and inward requests for photographs, information about text of the request, date and purpose, items of the request and photographs issued according to the request.

Within these subgroups and among them the tables are related as in the following scheme.

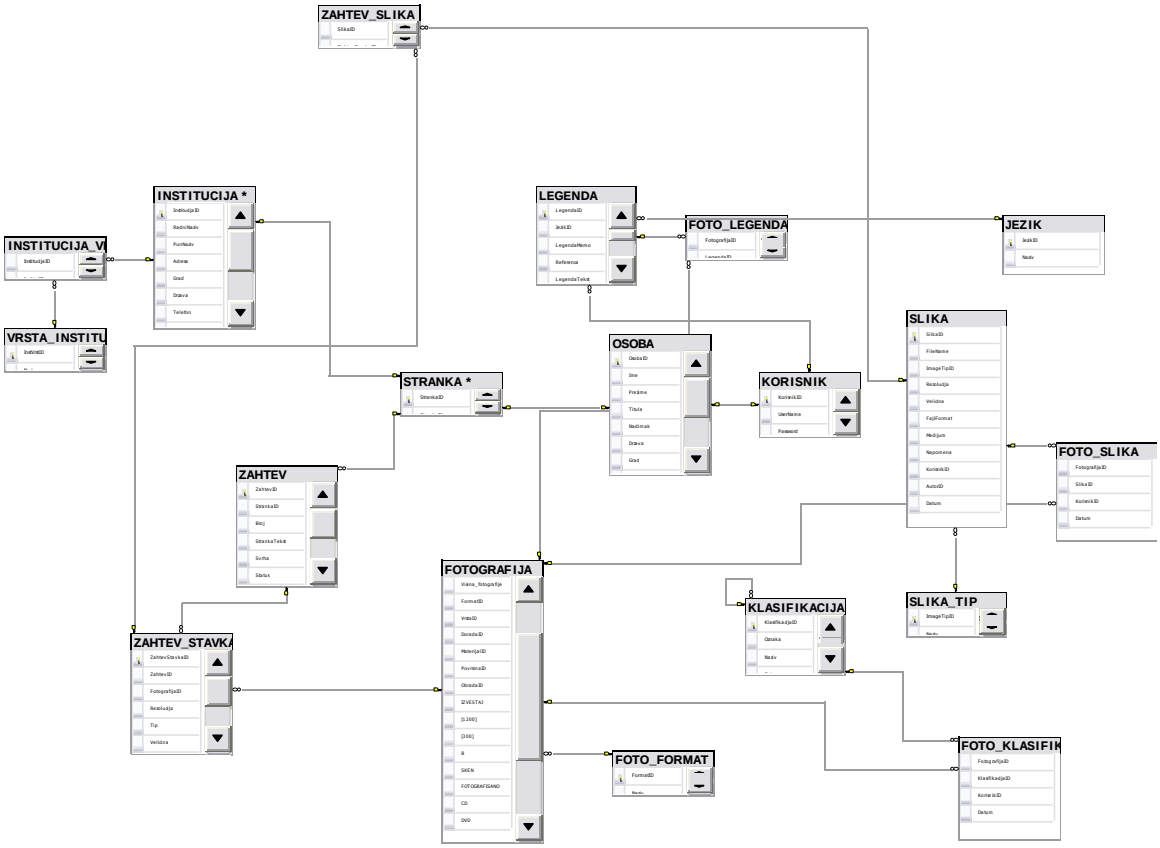

Fig. 1. Tables in database

Tesla_Photo application was designed with intention to enable:

- A more efficient search through materials, all available digital records and photographs data

Fig. 2. Program *Tesla_Photo*

The user can choose a specific classification subgroup, search thumbnail photos together with their unique labels (signatures), choose specific photograph and see the list of all available digital images and their characteristics, see descriptions of a photograph and their sources and see the enlarged digital image of the photograph in the screen resolution. Search can be done by signature or part of signature and by description of the photograph.

The user can also choose a number of photographs and as a result of processing his request a text document containing thumbnails, signatures and descriptions in requested language is generated automatically.

Existing software has not been finalized yet and it is planned to further develop and complement it with more functions and information relating to various aspects of description or use of photographs, that is, their digital copies. The software is also designed to be used for photo panels and slides from Nikola Tesla's Personal legacy once their digitization is completed.

Conclusion

Thanks to the digitization process, digital copies of photographs from Nikola Tesla's Personal Legacy can today be found, searched through and prepared for use in a very short period of time. Scanned and photographed materials can be, if necessary, modulated to the needs of external users (resolution, format). Digital copies have been already successfully used for the museum's exhibit and publishing activities. Another important aspect of using the digitized museum items is concept of virtual display of museum collections on the internet. Posting an entire collection or its part on the internet makes it possible for the entire world public to view the cultural heritage which is at the same time safely stored at the museum's deposit. Posting it on the internet can also be a way to receive some return information, fresh and useful, for example identification of a certain person on photograph.

Apart form preserving materials, the final aim of the process of digitization in the Nikola Tesla Museum, is making a unique information system which would virtually join all museum collections.

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ivana.zoric@tesla-museum.org