

Project Proposal - Three Archives

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1. PROJECT DESCRIPTION

The Centre for Curating the Archive (CCA) of the University of Cape Town is responsible for the collection, curation and digitisation of various collections. The CCA makes these collections accessible to artists, scholars, students and other community members by providing Web access, publications and hosting events and exhibitions to showcase the materials conserved ¹. Their collections include collections comprising artefacts and multimedia centred around three distinct historical events occurring in Cape Town. The Sequins, Self and Struggle archive, a collection containing multimedia objects from the Miss Gay Western Cape and Spring Queen beauty pageants ²; the Harfield Village collection, an aggregation of artefacts about the forced removals of the Claremont residents; Movie Snaps, a collection of photographs taken in and around central Cape Town before and after apartheid ³.

The CCA has successfully digitised the items contained in these archives and has stored the artefacts on local hard drives thus the information is inaccessible to scholars, artists, researchers and community members outside of the CCA. The Miss Gay Western Cape and Spring Queen archive has an existing online platform, however, the information is not presented in a manner deemed usable by the CCA.

The importance of the solution lies in the necessity to digitally preserve the cultural heritage presented in these archives, encourage users to add information thereby growing the collections and to increase the accessibility of the information contained. Issues currently being experienced involve the inaccessibility of the information in the archives, the manual management of the archived material and lack of exposure of the archives.

The problem to be solved is the need for an online representation of the multimedia files pertaining to the aforementioned archives. The solution is the development and implementation of a digital cultural heritage archive to allow for the storage, management and access of information representing the cultural heritage of minority groups in Cape Town.

2. PROBLEM STATEMENT

The aim of the project is to provide the CCA with a digital cultural heritage archive solution that will provide access to information that has been centrally stored and is currently inaccessible to society members outside of the CCA.

Together with providing access to cultural heritage information of minority groups in Cape Town, the aim of the project is to investigate and arrive at a solution that will

¹<http://www.cca.uct.ac.za/>

²<http://sequins-self-and-struggle.com/>

³<http://www.cca.uct.ac.za/projects/movie-snaps-capetown-remembers-differently/>

allow for the creation and management of additional digital heritage archives by the CCA.

2.1. Requirements

The Three Archives project has a client, the CCA. Potential users of the system are researchers, artists, scholars, historians and interested members of the general public. Below is an outline of the most important requirements to be investigated and implemented in the software solution to satisfy the needs of the CCA and the users of the digital archive.

The solution is to allow for the access and exploration of archived heritage artefacts via search and browse functionality. The solution will also allow community members the ability to contribute to the archive resulting in an archive rich in content. The contribution will be through commenting on and captioning items, as well as uploading multimedia content to the archive.

In addition to presenting cultural heritage artefacts of different multimedia types, the solution will house recordings of exhibitions that the CCA has conducted and will allow for users to construct personalised online exhibitions using the content that is available in the archive.

The system will allow the client to manage the archives by providing functionality to upload data to the archive, edit metadata accompanying the artefacts, and approve any submissions made by users. Together with the management functionality, the solution will provide information to the client about where in the world the digital heritage archive is being accessed from in order to obtain knowledge about the global reach of the archives.

Over and above the requirements stated, functionality to be provided to the client includes the ability to create new archives, post implementation, without the need to implement an entirely new solution.

2.2. Project Scope

The scope of the project does not include the digitisation and preservation of digital objects. The purpose of preservation is to protect digital objects for access by present and future generations. The long term preservation of digital objects involves making sustainable technological decisions for the implementation of the system. It will not be considered as the core requirement of the project is to create services that allows users to interact with the digital objects.

Encouraging users to make contributions to the archive is another element which is out of scope. This is since the objective of the project is to provide an archive for users that allows for contributions but not necessarily motivates users to contribute.

3. STAKEHOLDERS

This section identifies and describes the various stakeholders of the project and their roles.

3.1. Project Supervisor

Hussein Suleman

Responsibility: Review project deliverables

3.2. Project Team

- Nicole Petersen (Project leader)
Responsibility: The project leader is responsible for coordinating aspects of the project and ensuring team members are on schedule.
- Noxolo Mthimkulu (Secretary)
Responsibility: The responsibility of the secretary is to take minutes at project meetings and to make the minutes available shortly after the meeting.
- Noosrat Hossain (Communicator)
Responsibility: The communicator is responsible for communicating with the project stakeholders.

3.3. Clients and Users

Client

Siona O’Connel- Centre for Curating Archives

Users

Curator

Student/Researcher

General public interested in Cape Towns heritage

4. PROCEDURES AND METHODS

This section identifies the methods and procedures that will be implemented during the project life-cycle.

4.1. Development Features

The project will adopt a three-layered architecture for the implementation of the digital archive. These layers include an interface layer, a service layer and a back-end/repository layer as can be observed in Figure 1.

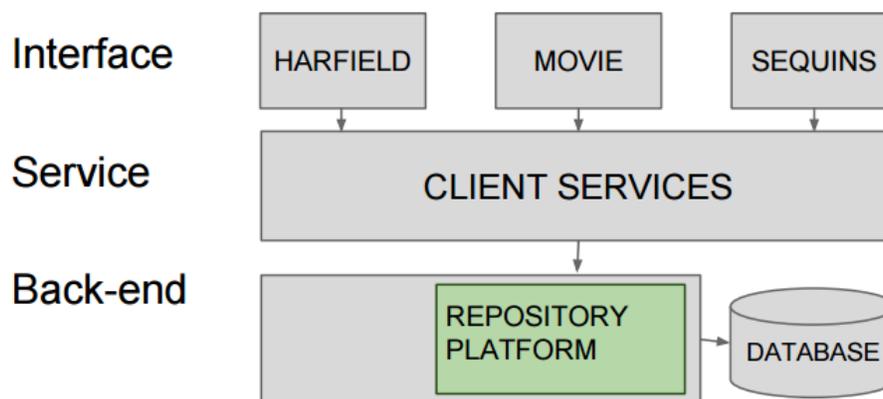


Fig. 1. Three Archives three-layered architecture overview

4.1.1. Interface Layer. The interface layer is responsible for linking users to the services offered by the archive. Given that the three archives are distinct in the context of the content they represent, three different interfaces will be implemented to allow for user interaction with the system.

4.1.2. *Service Layer.* The service layer connects the front-end interface to the data objects located in the back-end. The service layer contains the functionality that is available to the user to retrieve the information from the repositories.

The table below lists and describes the services to be implemented in the service layer.

Table I. Three Archives Client Services

Service Name	Description
Search and Browse	This functionality will provide access to and retrieval of the multimedia objects stored in the archive. The search functionality will be both a basic search and advanced search.
Exhibition	This service will allow users to view and custom-create exhibitions with narratives and captions dependent on items that they have selected from the archives. Once published, these exhibitions can be viewed by any user of the archive. The exhibition service will be split up into three components. Namely, the exhibition editor, the exhibition template editor and the exhibition viewer. The exhibition editor will allow users to select specific items from the archive. The exhibition template editor will allow users to select a template and specify the placement of items identified in the exhibition editor. The Template viewer will combine the template and editor to produce an exhibition that is viewable by the user.
Comments/Annotations	Users will be able to comment on items in the archive. For example, commenting on a dress in an image from the Spring Queen archive. This provides a mechanism to avoid communication through lengthy comments and conversations that is difficult to keep track of. The annotations will create richer data with more relevant information.
Maps	Data items in the Movie Snaps and Harfield Village collections will be displayed on a map. The user will be presented with checkpoints on the map representing where photos were taken. When enlarged, the user will be able to view the photos.
Upload	Users will be given the opportunity to upload and submit items that they believe are relevant to the archives. E.g. A dress, photo of old home, photo of great grandparents. We also want to create a simpler way for the curator to upload albums.
Low Priority/Additional features	
Download	Similar to shopping cart of e-commerce websites, this feature allows the user to select particular items within the archives to bulk download.
Statistics	The curator will be able to view statistics about the users of the archives, such as their location, time spent on the sites and heat maps. This functionality is relevant to the curator in order to obtain information about the global reach of the archives
History	This will allow users to track their movement on the archive and see where they have previously been. It will also be used, together with information from statistics, to provide a personalised experience for the users in terms of suggestions on new collections to view based on their previous browsing. The history functionality will also provide a view of any updates to the archives as a whole

4.1.3. *Repository layer (Back-end).* This layer involves the storage and organisation of the digital objects. The implementation of the repository layer will involve the user of an archival tool. This is further discussed in the development platform section to follow. The artefacts will be separately stored in a database. Throughout the duration of the project the system will be designed in a manner that will allow for the creation of new archives.

4.2. Development Platform

The Three Archives system will be developed for use over the Web and the system will be compatible with any Web browser. The interface will be responsive and will allow be accessible via mobile devices, however, it will be developed primarily for use on a personal computer. The front-end interface of each archive will be designed using HTML and Twitter Bootstrap, a front-end framework providing CSS files that allow for easier user interface design ⁴.

The repository layer will be implemented using the open source Fedora repository tool. DSpace and Omeka are other digital object management tools which offer additional services that Fedora does not offer. The additional tools will be investigated in order to obtain understanding of how they have chosen to implement services to be made available in the three archives project. The Fedora tool accommodates for complex digital objects and allows for customisation and flexibility. Fedora provides basic search and browse services which are exposed as web services and allows for the introduction of new services. Fedora has been implemented using the Java programming language and any additions to be made will be in Java. The database used in Fedora is PostgreSQL ⁵ which will be used for the Three Archives project.

The implementation of the Three Archives' services will make use of existing third party software where applicable. Table II is a description of the implementation strategies to be adopted for each service.

⁴<http://getbootstrap.com/2.3.2/>

⁵<http://www.postgresql.org/about/>

Table II. Services Implementation

Service Name	Description
Search and Browse	SOLR ⁶ will be used for the implementation of the searching and retrieval functionality. SOLR is an open source indexing and searching tool. Items in the archive will be collected then stored in a database using PostgreSQL. Solr will be used for the indexing of these multimedia items in order to ensure efficient retrieval when a search is conducted. The browse functionality involves displaying these items as well as a more generalised search through the archive. Solr will be used and any additional customisation required will be in Java.
Exhibition	The exhibition functionality will be self implemented. Using HTML and Javascript to create the exhibition editor as well as creating the templates needed to present the exhibitions
Comments	We plan to explore different Annotation tools. Annotator JS is a tool that allows annotations of text, a plug-in for this tool, called Annotorious, will be used to annotate images by creating a block around a section of the image the user wishes to comment on. The interface needs to be designed in such a way that the user is aware they are able to make these kinds of comments. For example, affordances where a box appears on the image when moused over as well as a hint
Maps	Google maps. This will be used to create an overview of Cape Town. The Google Maps Overlay class will be used to place marker of the images at the specific geographic locations on top of the map. Maps has its own built in pan and zoom to navigate across the map.
Upload	Dublin Core metadata standard
Low Priority/Additional features	
Download	Temporary database table holding items to be bulk downloaded. Will be done using PostgreSQL. Items will be stored in a zip folder for download, bowser settings will control from this point (Where and how stored on PC)
Statistics	Google Analytics/AWstats will be used. Google has a measurement protocol that provides a way to measure user activity in new environments and to tie online to offline behaviour. It allows you to automate reporting of activity and customise these reports to the system needs.
History	The history functionality will use information obtained from the statistics of the usage of the website and the users' activity. The personalisation of the experience and providing updates as to which archives and collections have been changed will be implemented in Java.

4.3. Implementation Strategies

4.3.1. Agile. The Agile software methodology will be adopted for the implementation of the Three Archives project. The Agile methodology is most appropriate as it lends itself to changes in requirements and handles time constraints that may be experienced.

Roles and Responsibilities Each team member will have a specific role where they have specific duties pertaining to the project. Many of the roles will be shared by all the team members as is indicated in Table III.

Table III. Agile roles and responsibilities

Role	Responsibility
Documentation Reviewer/Editor	Noxolo Mthimkulu. This member will check the spelling and grammar in documentation and ensure that the formatting of documentation is consistent, readable and neat.
Internal Tester	Shared by all team members during the course of the project. Unit tests will be conducted throughout the development process. In addition to this, code reviews will be conducted.
Software Architect	Changed over from member to member throughout the project depending on the feature being tackled. The member takes responsibility for overall technological design, integration and implementation of software foundation; manages and offers resolutions for technical problems related to software tools.
Developer	Shared by all team members during the course of the project.
Designer	Noxolo Mthimkulu, Nicole Petersen. Each member will design separate interface for one of the three archives. The head designers will design the basic standardised look and feel of the system as a whole.
Systems Analyst	Shared by all team members during the course of the project. All members will be involved in scoping out the requirements of the project. Identify and document the requirements of the project, identify project stakeholders, understand the clients needs and what benefits the client would like to derive from the project.

Given that the Three Archives project team is small and given the time constraints, a specific Agile project management methodology will not be followed but rather a combination of Agile concepts will be considered throughout the implementation of the Three Archives project. Principles to be adhered to are the iterative development process, testing will be conducted throughout the project at each iteration forms of which will be discussed in the evaluation section of the document, and constant client interaction to ensure satisfaction with the product. Additionally, at the beginning of each iteration, the tasks will be well defined and difficulty and time will be assigned to each task - this will be kept track of during the development process. The team will have daily stand-ups before beginning their tasks for the day to communicate to the team the progress of their tasks and what they intend on achieving for the day. Sprint reviews will be held at the end of every sprint to discuss the challenges during the sprint and how things can be improved for the next. Features will be developed in priority order. All required software engineering deliverables like time sheets and meeting minutes will be produced during the project and will be handed in with the final deliverable.

The system will be developed incrementally following an iterative approach where the first iteration will produce a minimal viable product. The iterations following will refine any services which have already been implemented and will involve the implementation of new services. Each iteration will result in a system that is complete and functional with increased iterations resulting in more complete functionality. The Agile software development methodology was chosen for the project as it enforces the requirement of a constantly working and complete system which will ensure a complete project regardless of time constraints and issues that may be encountered.

Agile also lends itself to the development and specification of new requirements throughout the development process which is fitting for the Three Archives project as the general idea as to which services are required is present, however, the detail is still unknown and adopting Agile will allow for sufficient exploration. Each iteration will enforce the Agile Development Cycle of analysis, development, testing and evaluation. This Reduces risk, and increases value by delivering some benefits early, results in more flexibility, and better time management.

4.3.2. User Centered Design. The client and users will be closely involved throughout the design process. The Three Archives project involves the design of three distinct interfaces for the three collections being represented. The users' involvement throughout the process is necessary to ensure that the system is usable and understandable and that all the services that will be implemented are well understood.

The user centered design cycle is iterative process and involves an initial evaluation phase, followed by design and then a prototyping phase. The evaluation phase involves the understanding of the different users of the system and the tasks they intend on completing using the system. This is coupled with an evaluation of how the users are currently completing these tasks in order to understand how to improve their experience. The evaluation process is followed by a design process where we will design the system taking into consideration knowledge obtained from the evaluation session. The design phase will be followed by prototyping, where a prototype of the design will be implemented and presented to the users for evaluation. Different levels of prototyping will be adopted throughout the design process dependent on which prototype fidelity provides the best feedback from the users. Feedback from the evaluation of the prototypes will be taken into consideration during the next iteration of the design cycle where improvements will be discussed, designed and then prototyped.

This iterative process will take place until the team is satisfied with the users' interaction with the system and the users' navigate and interact with the system intuitively and effortlessly. The CCA will be contacted to find users.

4.3.3. Expected Challenges. We have yet to receive any data from our client and unaware of where this data is kept. We expect it to be challenging to acquire this data from our client.

The client is very enthusiastic and often forgets that this is an honours project for Computer Science. So a challenge we may have already run into is meeting our clients expectations.

There are a number of services that we aim to provide that the archival tools do not provide. We expect it to be challenging to offer the specific services the way we intend. Using a variety of external tools raises the challenge of proper intergration.

The archive includes both sound and video media files besides images. We expect that to be challenging to deal with different types of media files and note that some services may work for some types of media types and some not, as well as extra precautions we may take to allow for extra multimedia capabilities.

One of the biggest challenges we believe this project will face is providing a system that wil give users the ability to be creative and designing the interface, features and funtionality in such a way where the user is aware of the capabilities.

4.4. Evaluation

We will use Software engineering metrics to evaluate our system. The outcome will be measured on both an application level as well as a project level.

On a project level calculating the cost of project as well as the time spent on each task, whether it went overtime, whether some functionality had to be reduced due to time constraints or whether there was over allocation of time to a specific task. Then the overall time and cost of the project

We will be using user oriented, performance based and requirement based evaluation. Using usability metrics like Learnability, recovery from errors, ease of use etc. we will evaluate the system using the speed and accuracy of results. We also want to measure whether the end product met the clients requirements, keeping in mind that this is still an honours project.

Several tests will be done with typical users of the system. Each test will be categorised by the user behaviour towards the system being tested, they will be evaluated against our expected outcomes to specific inputs.

Other tests that will be conducted include unit tests, usability tests , acceptance tests and integration tests.

4.5. Research Contribution

The system implemented will provide an easy means to create new archives using the same platform and providing the same services. An example of this would be another party needing to create an additional archive, the user will be presented with an API whose services will be used. We hope this project will be analysed and used in case studies, leading to a theoretical outcome.

5. ETHICAL, PROFESSIONAL AND LEGAL ISSUES

This section identifies the ethical issues involved in the various project phases, such as user testing, populating the database and the software implementation.

5.1. Testing

Ethical clearance is to be obtained as user testing will be conducted. It is necessary to obtain this timeously and before testing occurs in order to avoid any delays and issues that may arise. The ethical clearance will be accompanied by a form for the users to sign that ensures their confidentiality and anonymity in participation in the tests. Users representative of the client from the CCA and community members will be sourced for the testing of the system. Users will consent to the observation of their actions throughout the testing session and will be asked to provide feedback after the testing session.

5.2. Software

Software to be used in the development of the solution is all open source. The open source software will be utilised according to the terms specified. These are the tools that have been discussed in the Development Platform section above. Additionally, the solution will use services provided by third party software such as Google Analytics and will abide by the terms stipulated in the agreement of use of this software.

5.3. Data

The multimedia data to be presented on the digital cultural heritage archive solution will be sourced from the CCA. The digital archive will stipulate via the terms of use clause, to what capacity and in what manner the content of the archive can be used. This information will be obtained from the CCA and will be presented to the users. There is no obligation of the users to use the material as stipulated, however, full disclosure of the CCA's terms is the measure to be taken by the Three Archives project.

The developed tool will be the intellectual property of Nicole Petersen, Noosrat Hossain, Noxolo Mthimkulu; and the University of Cape Town.

6. RELATED WORK

This section outlines example digital archives that are related to the Three Archives project. The architectural implementation decisions, services offered and content are elements which make these archives related. Below is a brief discussion of what was notable in each implementation and which factors about the collections will be considered during the development of the Three Archives solution.

6.1. Zamani Data Archive Project

The Zamani Data Archive Project ⁷ is a project that was completed in 2014 by students from the University of Cape town. The project involved the implementation of a digital data archive for the Zamani Project⁸. The relevance of this project to the Three Archives project is the back-end implementation. The project was implemented using the Fedora⁹ framework as the repository layer. Fedora, as discussed above, is an extensible digital content repository service providing services for the storage, management and distribution of digital objects [Lagoze et al. 2006]. The Fedora repository architecture focuses on the object model which are templates for data objects and links to tools and services for managing these data objects. [Staples et al. 2003].

The Zamani Data Archive project used Fedora to store their dataset. The dataset was represented using the Fedora Object Extensible Mark-up Language (FOXML) which is an expression of the Fedora Digital Object Model. This would be relevant to the way in which the Three Archives project can store the data objects. Using Fedora digital objects will ensure that the objects use the Dublin Core metadata standard which will allow efficient object management. Zamani made use of the isMemberOf relationship functionality provided by Fedora to assist in the grouping and association of the data objects as well as the SOLR platform to assist in the indexing, searching and browsing functionality.

6.2. Nelson Mandela Cultural Heritage Archive

The Nelson Mandela Cultural Heritage Archive¹⁰ is a multimedia online archive containing books, photographs and videos about Nelson Mandelas life as well as interactions with family, comrades and friends. The archive has services for browsing, searching, making comparisons and an exhibition service. The comparison service allows the

⁷http://pubs.cs.uct.ac.za/honsproj/cgi-bin/view/2014/benson_ferguson.zip/

⁸<http://www.zamaniproject.org/>

⁹<http://fedorarepository.org/>

¹⁰<http://archive.nelsonmandela.org/home>

user to conduct a side-by-side comparison of two items in the archive as per Figure 2. The exhibition functionality provides a compilation of related items as decided by curators of the archive. The exhibitions are well captioned with descriptions in order to guide the user when viewing the exhibition. An example of this can be seen in Figure 3. This image represents an exhibition of all items grouped under the Nelson Mandela presidential years theme.

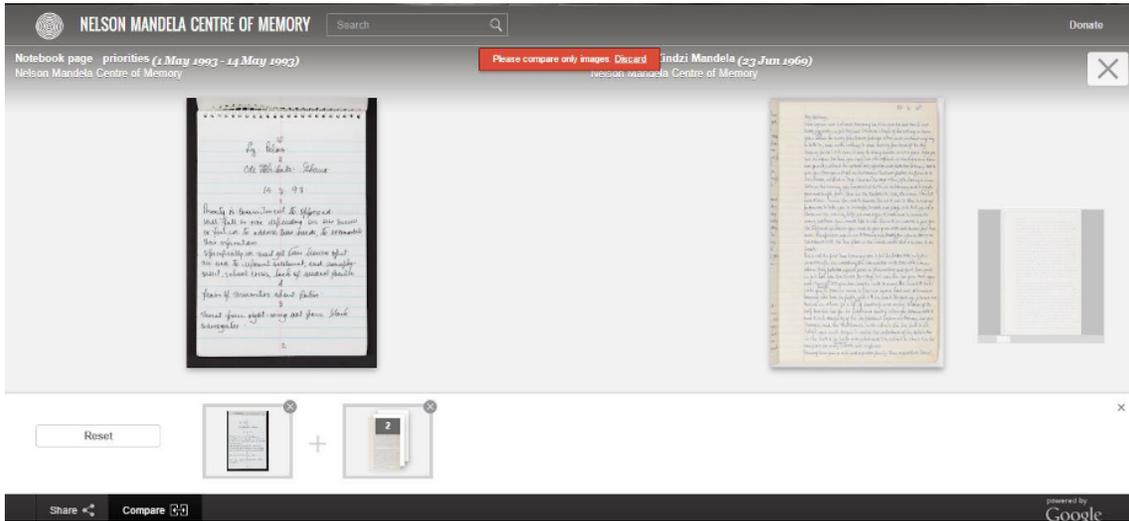


Fig. 2. Artefact comparison page from Nelson Mandela Cultural Heritage Archive

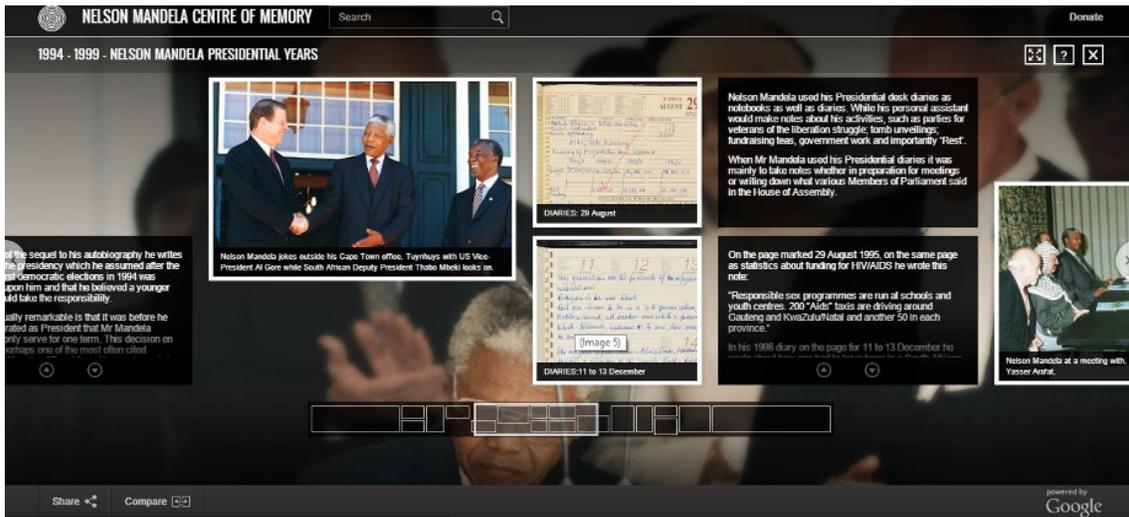


Fig. 3. 1994-1999 Nelson Mandela Presidential Years exhibition from Nelson Mandela Digital Cultural Heritage Archive website. Here we see a compilation of images of interactions and diary entries relevant to the exhibition title.¹²

6.3. Europeana

Europeana¹³ is a digital library that provides access to multimedia material located in digital libraries, museums and archives across Europe. The digital library, in addition to allowing for search and browse functionality to explore the archive, provides the users with virtual exhibitions that are themed dependent on what is selected by the user. Along with this they provide an aggregation of the latest contributions of all the different museums, libraries and archives that Europeana represents.

The Archive houses text, images, video, sound and virtual 3D representations. Europeana personalises the digital archive experience by allowing a user to save the search that they have conducted, allowing the user to add a tag to items and to store the items for later view.

During the exploration of collections, users have the option to include content which was contributed by other users. Europeana, thus, also allows a contribution mechanism which is observed in their Europeana 1914-1918 collection¹⁴ as seen in figure 4. The contribution is done by signing up to the site, adding information about the contribution, attaching a digital version of the object and submitting the contribution. Europeana then reviews the story before it is accepted and published¹⁵.

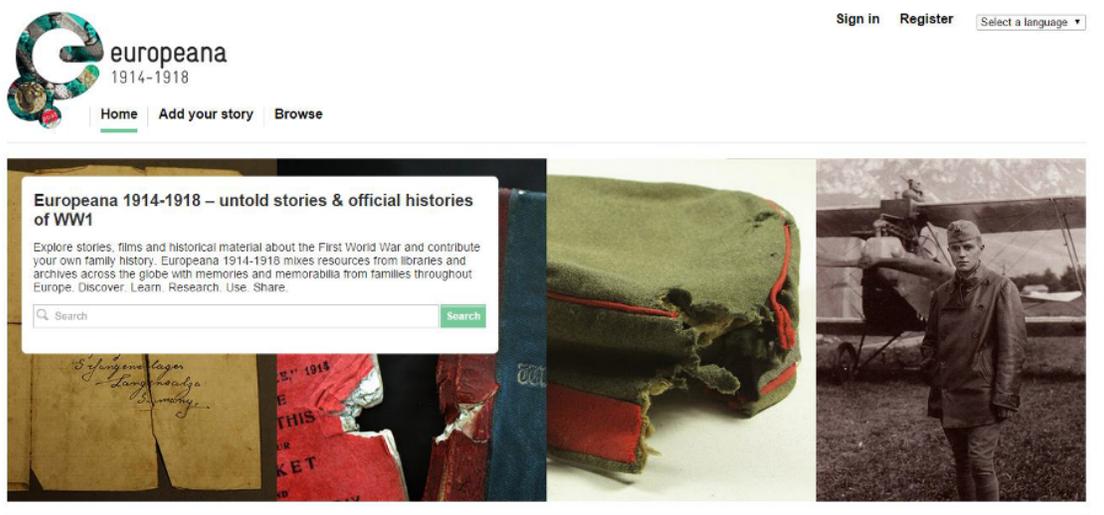


Fig. 4. Europeana 1914-1918 project - collection of stories, films and historical material about the First World War. Allows contribution

The elements discussed about the Nelson Mandela Cultural heritage archive, Europeana Digital Library and the Zamani data archive will be considered and incorporated in the implementation of the Three Archives project.

¹³<http://www.europeana.eu/portal/>

¹⁴<http://www.europeana1914-1918.eu/en/contributor>

¹⁵<http://www.europeana1914-1918.eu/en/contributor>

7. ANTICIPATED OUTCOMES

The identification of anticipated outcomes of the project will allow us to evaluate the progress of the system. The outcomes include the implemented system functionality, implementation challenges and success factors.

7.1. Project Outcomes

The Three Archives project is expected to make the three archives accessible to users. It will consist of three integrated layers whose expected outcomes are described below.

7.1.1. Back end. The back-end is expected to provide a foundation for the management and storage of the digital objects. The back-end includes a database for the digital objects. The digital objects will be managed using DSpace, Omeka or Fedora, as discussed above.

7.1.2. Services. The services that are expected to be made available include:

- Browsing and Searching
- Curator uploads
- Curator acceptance/rejection of user contributions
- User uploads
- User Comments
- Creating an exhibition
- Map of content uploads

Low priority/additional services that could possibly be implemented include:

- Website Statistics
- User History
- Downloading content

7.1.3. Front end. The front-end is expected to provide three distinct user interfaces for the Three Archive collections. The interfaces will expose the services available to the users and will provide a channel to perform system services.

7.2. Challenges

Design challenges that may arise originate from the data that is currently available and the tool selected for the foundation of the system. Missing metadata fields may result in inconsistent data which will affect the results represented to the user. It is therefore required that the data be curated. Another design challenge involving data is the size of elements that need to be uploaded. The database must be designed to handle large files while maintaining their quality.

The restrictive nature of repository tools available may result in the inability to customise services based on the requirements of the Three Archives project.

Additional difficulties that may be experienced involve the integration of all the tools to be used as the implementation of the project involves the use of various existing tools. Together with the integration, various difficulties are expected during the implementation of the actual services of the archive. These difficulties include presentation of an archive to a creative audience, the integration of sensible workflows in order to allow users to use services such as exhibitions and the annotations, the interpretation of the statistics and history of the archives in order to provide a personalised user experience and the implementation of a fluid browsing interface.

7.3. Success Factors

The success of the project is based on the ability of users to access cultural heritage information effectively from the three archives. Additionally, users should have the ability to add information to the collections and should enjoy a personalised archive experience. A successful implementation of the Three Archives project will include the ability for the number of archives to increase.

8. PROJECT PLAN

The following section describes the life cycle of the project. The description involves an identification of potential risks, resources required, deliverables, milestones and work allocation.

8.1. Risks Matrix

Risk	Consequence	Mitigation	Monitoring	Management
Schedule				
Too much time spent on exploring which repository tool is best suited.	The entire project will be delayed or may result in a solution that needs to be newly developed.	Only test tools that have been successfully used in similar projects and set a time frame for exploring each tool.	Monitor whether the project schedule is being adhered to.	Adjust the project schedule and make scope reductions if necessary.
Milestones not being met in time	The entire project will be delayed	Adhere to the project plan so that tasks begin on schedule.	Monitor whether the project schedule is being adhered to.	Adjust the project schedule and have an emergency group meeting.
Unrealistic schedule	The project might not be completed in time, resulting in less time for system testing.	Ensure enough time is allocated for each task.	Monitor whether the project schedule is being adhered to.	Adjust the project schedule and make scope reductions if necessary.
Poor time management	The project will run over time if members do not manage their time properly.	Always keep things organized and have weekly team progress meetings.	The project leader should check whether team members are coping with the workload.	Adjust the schedule or reassign tasks.
Project Scope				

The scope of the project changes last minute	Team members will not have time to implement the changes	Regular meetings will be conducted with the project supervisor and client.	Monitor the project scope	Change the schedule if the scope is changed
Development				
Difficulties in the development of a major task .	The development of other tasks which depend on that task will be delayed	Ensure tasks are assigned effectively and take into account task dependencies when making this decision	Ensure that the tasks are being carried out on schedule by having weekly progress meetings	Adjust the project scope or adjust the project schedule.
Stakeholder				
Stakeholders such as the project supervisor or client become unavailable	Schedule delays may arise if the project cannot continue without consulting the respective stakeholder.	Agree on days when the stakeholders will be available.	No more than 2 consecutive meetings should be missed with stakeholders due to unavailability	Discuss the issue with the project client/supervisor to either adjust time or services offered
Communication				
Lack of communication between team members	Project tasks might overlap while others might be overlooked. This may lead to confusion and conflict between team members resulting in the failure to meet the needs of the project.	Team members will meet regularly. Make use of Google drive to ensure all resources are accessible to team members	Team members must contact and update each other at least once in 36 hours range.	A meeting must be held to discuss the current communication methods and make suggestions on adopting new ones
Lack of communication with stakeholders	The needs of the client may not be met.	Ensure that there are communication links between stakeholders and project team at the early stage of the project. Agree on the preferred method of communication	Be able to communicate with stakeholders at least once in a week.	Discuss the issue with the project client to either adjust time or services offered
Resources				

Unable to obtain users that reflect actual real world users of the system for testing.	The results of the user tests will be unreliable	Ensure users are available to test the system when the testing phase is scheduled	Ensure users will be available for testing a week before the testing session is scheduled	Find alternative users to test the system with
Delays in receiving data from the client	The solution will not be able to be tested due to the database having insufficient/missing information.	Design database in such a way that it only requires information that is available and accessible.		Create dummy data to populate the database.
The tool selected to develop the system is too restrictive	The system will not meet the needs of the user or the client.	Ensure that the phase of exploring the various tools is done effectively.	Have progress meetings with the team to discuss any difficulties arising from the tool.	Adjust the services to be offered or select another tool if there is sufficient time
Team members dropping the course or being sick	Scheduled time will be lost resulting in the project being late. The work of other team members could also be delayed if they depend on the missing team member.	Ensure work is allocated in such a way that it reduces task dependencies between team members.	Have regular team meetings to check whether a team member is delay another team member's work.	Tasks can be re-assigned in the team if this were to happen.

Table IV: Risks Matrix

8.2. Timeline, Including Gantt Chart

The Gantt chart shown in Appendix A identifies the three iterations of the project life cycle as well as the project deliverables and milestones. The implementation of a service is not expected to be fully functional at the end of the first and second iterations. The Gantt Chart identifies when the implementation of the services must begin.

8.3. Resources Required

The project requires various resources such as a software tool to form the foundation of the system, users to test the system and content to populate the database.

The content required to populate the database is information from the three archives previously mentioned.

The users that are required to test the system include researchers/scholars, cu-

rators and the general public interested in Cape Towns cultural heritage.

Three tools will be considered to provide the foundation of the system. Possible tools includes Fedora, DSpace and Omeka.

8.4. Deliverables

- Initial Feasibility Demonstration
- First Implementation/Experiment/Performance Test + Writeup
- Final Prototype/Experiment/Performance Test + Writeup
- Chapters on Implementation and Testing
- Final Complete Draft of Report
- Project Report Final Submission
- Project Poster
- Project Report Final Submission
- Poster
- Website
- Reflection Paper

8.5. Milestones

8.5.1. Project milestones

- Initial Feasibility Demonstration **2015-07-20**
- Background chapter complete **2015-07-24**
- First Implementation **2015-09-11**
- Final Prototype **2015-09-21**
- Chapters on implementation and testing **2015-09-25**
- Final implementation **2015-09-25**
- Final Complete Draft of Report **2015-10-16**
- Project Report Final Submission **2015-10-26**

8.5.2. Software milestones

- Back end (repository and foundation of the system)
- Services (Service functionality)
- Front end (interfaces to the services)

8.6. Work Allocation

Work will be allocated according to the expected difficulty of each task as well as the ability for the back-end tool to provide support for these tasks. The table below identifies the services to be implemented by each team member and during which iteration the implementation is to begin.

During the first iteration all team members are expected to explore different repository tools that will form the foundation of the digital archive. Thereafter, each team member will implement their respective services. During the third iteration no implementation of new services are expected to take place as this iteration improves the functionality implemented during the first two iterations.

Table V. Work Allocation

Iteration	Nicole	Noxolo	Noosrat
1	Omeka	Fedora	DSpace
1	View an exhibition	Basic Search	Map geo-tagging
2	<ul style="list-style-type: none"> — Create an exhibition — Uploads 	<ul style="list-style-type: none"> — Advanced Search — Browse — History and Statistics 	<ul style="list-style-type: none"> — Comments (Annotations)
3	Refine services		

REFERENCES

- Carl Lagoze, Sandy Payette, Edwin Shin, and Chris Wilper. 2006. Fedora: an architecture for complex objects and their relationships. *International Journal on Digital Libraries* 6, 2 (2006), 124–138.
- Thornton Staples, Ross Wayland, and Sandra Payette. 2003. The Fedora Project. *D-Lib Magazine* 9, 4 (2003), 1082–9873.

