

From Collective Memory to Map Services

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Abstract

The route followed by a refugees' group towards its destination can, in many cases, be regarded as the reference point around which the collective memory of such a group of people is intertwined. Such a route enriches people's memories with common experiences, targeting places and interactions among refugees and locals and may affect the collective memory of such people positively or negatively. A crucial point in the modern paradigm of smart cities is the quality of life. To achieve quality of life for its citizens a smart city should establish ways to reduce alienation among the different groups that constitute the city's palimpsest. Understanding the different cultural identities and improvement of social cohesion between different people groups is one of the basic vehicles towards this goal. In this paper, we attempt to give a first answer to such problems proposing and implementing specific services in the context of a crowdsourcing system for collective memory management using interactive maps. We demonstrate a basic usage scenario to show the strength of the implemented services, along with a two-step evaluation showing positive results.

Keywords: *Crowdsourcing; Collective Memory Management; Big Data; Mobile Services and Platforms*

1. Introduction

Nowadays, people often lose their land due to catastrophic events or war, they become refugees and move to new countries where they might live forever. Consequently, the cultural bonds of refugees with their homeland are weakening. Along their travel, refugees stop at places where they might stay for a long time interacting with the local population. This interaction results in the adaptation of certain habits and the production of specific memories associated with those places that can be added to their collective memory concerning or not the traumatic event they faced.

Also, people often become immigrants by choosing to resettle in another country seeking a better life. In this case the conditions are clearly better since the movement is usually organized and targeted. These groups usually aim for a better life in places that favor this condition. Halbwachs, referring to his own case, commented in a brilliant way on one aspect of his life in the place where he chose to live "It did not take me long to establish friendships. But I felt for a long time that there was something in my relations with Native Americans that blocked full communication" [1]. Of course, he was referring to the barrier that was produced by the fact that he was a member of a different collective memory (CM) from the locals.

CM is recorded in people's minds and is one of the elements that make groups of people different. However, in our times, we have the capability of using new technology to record and manage this memory. The Internet has become an important social space and the belief that CM can be preserved there is common. In recent years, more and more places on the internet aspire to record,

preserve, or spread the common memories of people. Also, new tools have made it easy for everyone to create meaningful and beautiful visualizations of collected data (like infographics [2], maps [3] and interactive maps [4]–[6]).

Refugee and immigrant flows are often displayed with the help of visual aids such as maps. But such maps mainly focus on numbers and flows ignoring the actual memories. Could we use these data to create interactive maps containing refugee routes? Would it be meaningful for us to get to know them better? To read stories from refugees' journey, to read about their way of thinking, the things they did, the people they met.

This work, based on [7], [8], extends the work by [9] proposing the Extended CrowdedPower (ECP) system which targets to the provision of preservation, management and dissemination services of refugee collective memory through their stories. Here, we are interested in the offering of additional services to users of a crowdsourcing (CS) system, which can be accessible through the portal or the mobile devices, satisfying the need of managing and disseminating collective memory related to the routes of displaced people. The ECP focuses on the adoption of the flow map approach to record and present the journey of various refugee populations. For such a system the basic entity is the route. A route consists of specific places where a refugee population stays for a time period along its travel towards the final destination. At each stopping place various personal or group stories are added to the collective memory of the moving population. The aim is not to create a detailed interactive map following all the principles of cartography. The basic goal of this work is to present a system that preserves refugee memories and disseminates them grouped in routes with the use of maps. This would help users to get an overview of the refugee route and their stories facilitating the understanding of different cultural

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identities. To the best of our knowledge such a system does not exist.

In order to create a system that manages and disseminates the collective memory of refugees, we followed a specific number of consecutive actions taking into account the corresponding literature, the targeted audience of the system and related systems. First, we determined the system requirements with the help of literature and related implemented systems, which then have been filtered with the help of the local community. Second, we proceeded to the system design considering data security. Then, we implemented the system using open-source technologies. Lastly, we evaluated the system. Taking evaluation results as feedback, we fine-tuned the proposed system.

A determinant factor throughout this process was the system audience. Nothing would be possible if the local refugee community has not been involved. These people motivated us to create the system to preserve their cultural identity, so it was easy for us to collect their memories. But there was a problem. Despite the fact they were willing to provide material, they could not do so because they were too old and technology illiterate. The solution was given by their descendants that helped with this process. Of course, a mobile application for the digitization of the cultural content was necessary to be created. Images of memorabilia were taken; interviews were recorded, and stories were down in the system. Besides the refugees, we addressed to general population to specify the services for the content dissemination.

This rest of this paper is organized as follows: Section 2 is dedicated to key concept of this work: we briefly present what collective memory is, we discuss about crowdsourcing and present applications related to cultural heritage and collective memory, we underline the role of such applications in the modern digitized world and finally we indicate the role of presenting information with the use of interactive maps. In section 3 we present the user requirements specification of the system. In Section 4 we describe the system, along with the services that facilitate the concept of the refugee route. A basic usage scenario is presented in Section 5, demonstrating the services. A two-step evaluation of the system is given in Section 6, demonstrating the strength of the implemented system in comparison with related works followed by results discussion. Finally, in Section 7 we present our conclusions and point out some future work.

2. Related work

Halbwachs was the first who dealt with the CM defining it as the recollections of events shared by a certain group [10]. Moving forward, CM is being studied by researchers from many fields and thus, "in the broadest sense, its meaning can be understood as interrelated group views of the present and past which exist in a certain socio-cultural context and influence the behavior of people in the future" [11]. Pierre Nora has also worked with CM and he states that "the enthusiastic interest in the study of collective memory in the modern world has led to two things: first, the past is now being used more intensively for political as well as touristic and commercial goals; and second, the historian is deprived of his traditional monopoly of interpreting the past and must now share this role with a judge, a witness, a legislator, the media" [12]. CM is a number of representations of the past that are collectively adopted and assembled into narratives and can be related to the popular memory or the official one [13]. But how can we create digital collections of CMs?

To represent collective memory of a community, a large volume of heterogeneous data should be collected. This is a tedious

process that incorporates many challenges regarding content recording, uploading, storing, and organizing. Such challenges appear in all aspects of Big Data and have a serious impact on the quality and security of data management [14]. Crowdsourcing (CS) promises to help the collection of data for several real-life paradigms [15]–[17]. Still, there are issues such as the control of the content quality, task assignment and finding ways to motivate volunteers [17]. Targeting Cultural Heritage (CH) the challenges include focusing on semantic web techniques, gathering loyal users and quality assurance [18]. To overcome those challenges, we have modeled collective memory data in a coherent context considering user needs in terms of raising user awareness and facilitating users operating as memory carriers. Regarding quality assurance, cameras, camcorders, and smart mobile devices with many capabilities are now easier to be obtained by non-experts [16]. Also, the problem of soundness concerning crowdsourced content remains. A solution to this problem is based on content authoring by specialists [19], [20]. Such a technique has been adopted to ensure the quality of the collected content. The developed system applies an authoring mechanism, asking expert users to comment on the validity of the provided content and permitting any registered user, expert or not, to rate the corresponding post. We believe that CS is a solution for digitizing memories related with intangible and tangible heritage by involving citizens that can contribute memories associated with specific memorabilia they own.

One of the most known CS systems in CH is the project called "Europeana 1914-1918". It is a project created to gather the untold stories and official histories of World War I. People can upload their data and a repository available to the public disseminates all that information through a portal [19]. The project "1001 stories about Denmark" focuses on stories from Denmark and tries to raise people's interest about the history of the country [21], [22]. Using a portal or a mobile app, registered users can upload their stories along with connected digitized material to a certain point on a map. "HistoryPin" is mainly focused on groups of pins about particular places and themes gathered by their members [23]. These groups of pins are named collections. Each pin is a mark on a map, which can contain text, images, audio, and video items.

Several systems have been developed targeting CM. In [8], we introduced a system that was trying to provide answers related to displaced refugee populations in terms of understanding their diversity from indigenous peoples and the alienation reduction, the recording and improving their quality of life and the recording and preservation of their intangible cultural heritage. The system proposed in [7], collects and manages refugee stories disseminating them to the public. The main target in [7] was the presentation of evaluation methodologies for CM systems and the study of such system impact to the people that are involved. In [7], although the effort was to record the collective memory of the refugee groups, there wasn't the route concept as the main negotiating entity. The Singapore Memory Project [24] aims to capture and document precious moments and personal memories, via a portal and mobile app, related to Singapore not merely from individual Singaporeans, but also from organizations, associations, companies and groups. Those memories are related to Singapore events, personalities, and places. Digital memories can be deposited in the form of text, image (JPEG) or video (AVI, MOV, MP4 and WMV) files, with the option of including the geolocation of the memory. Finally, in [25] they ask city residents to submit their personal memories and stories. They store and represent these stories with the use of virtual maps.

We should also underline the value of systems that deal with the collective memory of groups of people. In [26] the recent years,

we are talking about the large deployment of the Internet of Things that is empowering Smart City tasks and activities everywhere throughout the world. Systems that care about the smart management of information in the context of a city have already been implemented [23], [27]. However, CH is a predominantly unexploited asset presenting multiple integration opportunities within city contexts [28], [29]. Moving to CM, in [30] researchers describe an urban computing application that allows forming and interacting with the collective city memory. The collection procedure of personal storytelling was based on crowdsourcing. Students were asked to collect personal memories from their family and relatives. They state that their “system services can benefit the transformation of a city to a smart one”.

But this work is not only about collecting data. It is also about presenting them with the use of maps. Flow maps are used to visually present the entity's flow between geographical locations [3]. The main objective of such maps is to facilitate users to easily understand aspects of the entity's journey (related to the starting, the ending point and each stopping place) providing users information related to the scale and direction of the flow, along with knowledge about each stopping point. Researchers [4] present methods for creating accurate interactive maps of the refugee's movement. In [31] it is stated that “maps also cover individual movements, which are no longer labeled “flows” but “routes” or “journeys”, along with spatial data with social, political and/or temporal data”. Can we create maps of the

crowdsourced data and present them to the public? A first answer to this question is given by the system in this work.

3. User Requirements

User requirements specification of ECP follows a similar approach with the corresponding design phase of the first version of Crowdpower. ECP is targeting the collective memory management system able to handle different types of users, from refugees and their descendants to general population, specialized audience, and specialists. A main target was to create a secure system that was dealing with the diverse user needs to preserve and disseminate refugee stories. Towards this aim, a three-step procedure was followed. Firstly, we searched the literature (designed and implemented systems) [19], [21]–[23], [32]–[34] for collective memory management systems regarding specific features (preservation, diffusion, type of content) of CM management systems. Then we filtered the results with the help of specialists in the fields of cultural heritage management and history by contacting interviews. Based on the specialist's filtering, we created a questionnaire to investigate the user preferences regarding content and interface functionalities that were given to the system's real audience. The analysis of these results led us to create a set of requirements in Table 1.

Table 1. User requirements for portal (p) and mobile app (m)

Category	Requirement
Main objective	Preserve, manage, and disseminate data (p) - Satisfy educational needs (p).
	Collect as much material as possible and disseminate basic content (m).
Environment (friendliness)	Stories and routes should be presented in an attractive and comprehensive manner (p, m).
	Users should be able to download published content (p).
	Stories should be sorted using ready-made thematic categories and routes (p).
	Finding, downloading, and installing the app should be an easy and quick process (m).
	Ease of use (p, m) - Explanatory captions should exist in the user interface (p, m).
	Help in the form of explanatory videos and explanatory captions should exist where needed (p, m).
	Easy digitization process without any complexities (m).
Services	Content should be presented with the help of visual tools – maps (p).
	Volunteers should be able to: upload content to the system (m) - create and manage owned stories and routes (p, m) – publish, unpublish and preview unpublished content (p, m) - see the stories that have been published by all volunteers (p, m).
	Registered users should be able to: access stories and routes, to annotate and comment them (p) - create and manage collections of routes and stories (p).
	Cultural content managers should be able to author content, assign roles, annotate, and manage comments by specialists (p).
	Registered users that have an expertise in history-culture-anthropology should be able to: annotate stories and routes (p) – check for inappropriate content and take actions (p) – rate the uploaded material (p) – author user comments (p).
	All users should easily register the system (to become registered users or volunteers), view and search for stories and routes, share content to the social media (p).
	Registered users should create and manage collections of stories and routes. Also, they should be able to rate content (p).

4. The System

This work presents the ECP system. A system prototype has been already implemented in <https://crowdpower.e-ch.eu> hosting most of the services.

4.1. Architecture

Fig. 1 demonstrates ECP. It consists of three modules: the system databases, the authorization manager, and the application module (portal and mobile app). The Data Management Module contains four databases (DBs): User Contributed content, Public Presented Content, Security and System User Information DB. An Authorization manager is used to assist the authorized access to the databases. The Application Module contains a Portal and a Mobile App designed to interact successfully and efficiently with the users.

4.1.1. Users

The authorization manager is based on an extended version of the role-based access control model [35] and facilitates five types of users (cultural content managers, specialists, regular users, advanced users and volunteers). Users can perform actions interacting with the application module (Portal and Mobile App). All users except Regular Users need to be registered to the system.

- **Regular Users (RU)** are users that use the system to access and share published stories and routes. They are assigned the system's dissemination services.
- **Advanced Users (AU)**. By registering the system, a RU becomes an AU. These users can perform any action of the RU and additionally they can use the specialized services. This gives them the option to

create and manage collections and rate stories and routes.

- **Volunteers (VOL)** are refugees or refugee descendants that can contribute stories and create routes to the system. They have full access to their content so they can publish or unpublish routes and stories.
- **Specialists (SPE)** may be historians or social anthropologists that thoroughly check the content that is uploaded by VOLs. They can also perform rating and annotation on stories and routes.
- **Cultural Content Managers (CCM)** are responsible for authoring (after the specialist's advice) and also tasked with system technical issues. They also assign roles to SPEs and VOLs.

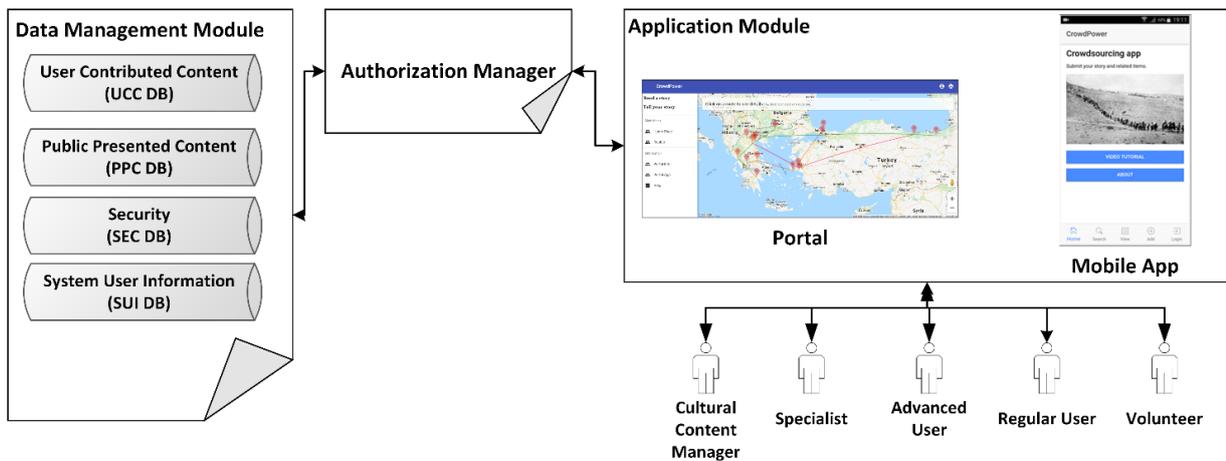


Fig. 1. The proposed ECP overview.

4.1.2. Content

System content is mainly produced by VOLs (routes and stories). However, AUs, CMMs and SPEs can create their own content (rates, comments, and annotations) on published content. VOLs can create stories attached to a specific place using the portal or mobile interface. Each story may contain text (like dates, story description, names of related persons), video (like narrations and films), audio (like descriptions and testimonials), images (like family pictures, letters, and maps). Each story is connected to a certain place with the help of GPS coordinates. VOLs can use their uploaded stories to create routes. System databases are the following:

- **User Contributed Content (UCC DB)** holds stories and routes created by VOLs and are ready to be published.
- **Public Presented Content (PPC DB)** contains the published VOLs stories and routes. These data can be annotated by SPEs or CCMs. These data are also manageable (delete, unpublish) by CCMs. Finally, the collections created by AUs are stored here.
- **Security (SEC DB)** is a database that contains the recording of user actions to the system.
- **System User Information (SUI DB)** contains data regarding authentication and user's role information.

The basic operations on data are: View, Search, Delete, Insert, Edit, Annotate, Rate and Publish.

4.1.3. Implementation technologies

Free internet technologies were used for the prototype implementation indicating that such systems can be created with low cost. An apache server hosts the portal and a file system for the uploaded VOL material. Maria DB was used to store all Databases. Authorization Manager was coded with PHP. The Application Module was built using edge technologies. The Mobile App was implemented using the Ionic Framework that can easily create distributions for both android and iOS devices. The test platform was an android mobile phone with android 7.0. The portal was built using an Angular2+ version creating a single page application. The development was held on a pc with Windows 10, i5 CPU and 16 GB ram.

4.2. System services

System services extend services proposed in [8] and [9] adjusting them to target the dissemination of refugee memories concerning refugee routes from homeland to their destination. Initially, the services were classified based on the targeted application module (portal services and mobile app services). However, in this work, we moved to a redesign of the provided services motivated by our intention to further investigate the user preferences regarding the use of a portal, or a mobile app as regards cultural content. In [36] there is some discussion about the cultural content when it comes for mobile or portal but what about more complex functionality such as the management of user uploaded data? In this work most of the services are currently provided to the users through a portal and mobile app. System services are presented in detail below and briefly in Table 2.

Table 2. Types of services dedicated to user roles

Category	User	Services
Crowdsourcing	VOLs	Add Story, Update Story, Publish Story, Unpublish Story, Delete Story, Add Route, Update Route, Delete Route
Core	All users	Registration, Authorization, Help, Download
Dissemination	All users	Story Search, Story View, Social Media Share, Route Presentation
Specialized	AUs	Create Collection, Edit Collection, Delete Collection, Rate Story, Rate Route
	CMMs	Authoring, Role assignment, Annotation, Edit or Delete Comments
	SPEs	Annotation, Edit or Delete comments

4.2.1. Core services

Core services is a category that contains system functions that are used by all system users.

- **Registration** provides the tools to create an account to the system.
- **Authorization** is an inner function that determines what users can and cannot access.
- **Help** is offered to the users in the form of advice on the home screen
- **Download** helps users download all desired information using the portal.

4.2.2. Specialized services

This category includes services that are highly specialized to specific system users (AUs, SPEs and CMMs).

- **Create Collection** allows AUs to create collections of stories or routes.
- **Edit Collection** helps AUs to add stories or routes to their collections. They can also remove stories or routes from their collections.
- **Delete Collection** allows AUs to delete a collection they own.
- **Rate Story:** AUs can rate any published story using this service.
- **Rate Route:** AUs can rate any published route with this service.
- **Authoring:** the authoring service is provided to CMMs so they can delete or unpublish stories or routes by following the advice of SPEs. Stories that are offensive are to be deleted and stories or routes that do not meet the quality standards are to be unpublished with advice to the VOLs for corrections and improvements.
- **Role assignment:** CMMs can use this service to assign roles that the users request. For example, an AU can request to be a VOL or a SPE.
- **Annotation:** SPEs and CMMs can add their comments to the VOLs about routes and stories.
- **Edit or Delete comments** is for SPEs and CMMs to help them delete or edit their comments on any content.

4.2.3. Dissemination services

Dissemination services are for the presentation of the uploaded stories and routes. This category is used by all system users.

- **Story Search:** users can search the stories depending on their role. For example, AUs, RUs and SPEs can search the published stories. VOLs can also search

their uploaded stories and CMMs can search for any story that is published or unpublished.

- **Story View,** users can view stories depending on their role (as is in story search).
- **Route Presentation** to support a comprehensive view of the routes. All routes are presented concurrently based on the functionality of google maps. Each route is presented with a different color and the contained stories are presented in brief when the user selects one.
- **Social Media Share:** all users can share a published story to the social media.

4.2.4. Crowdsourcing services

Crowdsourcing services are provided either by the app or by the portal and are permitted only to VOLs.

Add Story: A VOL can log in to the system and add new stories. These stories are by default unpublished (stored in UCC DB) and cannot be accessed by others.

Update Story: VOLs update the unpublished stories they own.

Publish/Unpublish Story: VOLs can publish their stories and all story content is immediately being transferred to PPC DB. Unpublishing stories is the reverse process.

Delete Story: VOLs can delete stories they own.

Add Route: A VOL can also create routes: A route should contain at least two stories (stories contain GPS data). The first story is the start point of the route and the last one, the destination points. Routes are always published, and their owner can update them anytime by adding or deleting stories.

Update Route: New stories can be added to a route by the route owner. Also, stories can be deleted from an existing route.

Delete Route: A route can be deleted by its owner.

The new crowdsourcing services regarding the routes were designed for both portal and mobile app and have been developed currently for the portal. System portal contains services for the management of imported routes by SPEs and CMMs. Services that allow VOLs to create and manage routes using the mobile devices have been designed.

5. Basic usage scenario

As a case study, we chose to deal with the collective memory of refugee groups coming from Asia Minor to Greece at the end of the first quarter of the twentieth century. For such a system the basic entity is the route. A route consists of specific places where a refugee population stays for a period along its travel towards the destination. At each stopping place various personal or group stories are added to the collective memory of the moving population.

The portal contains all necessary dissemination functionality. By visiting the system, guests can access the content of published

stories and routes. In Fig. 2 there is a demonstration of the routes contained in our system.

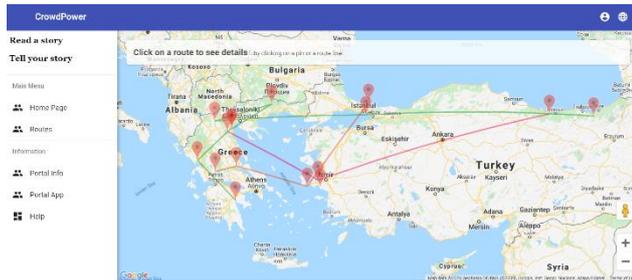


Fig. 2. Application Portal: Presentation of routes.

In Fig. 3 a RU has clicked on a route and has accessed the route's name and information about contained stories. Each story can be contained to a single route.

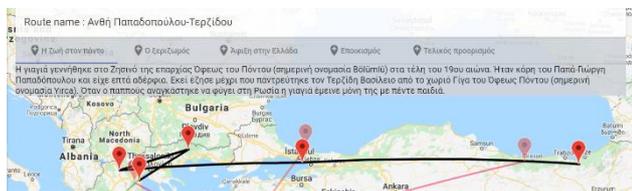


Fig. 3. Application Portal: Displaying route information.

Volunteers can access services dedicated to story management that are included in the portal. The user must be connected to the system and have acquired the role of volunteer. In Fig 4. we demonstrate the “Manage Stories” section. The user has created and published five stories. He/she can easily delete or view (change) any of the stories. These published stories can be stories of a route.

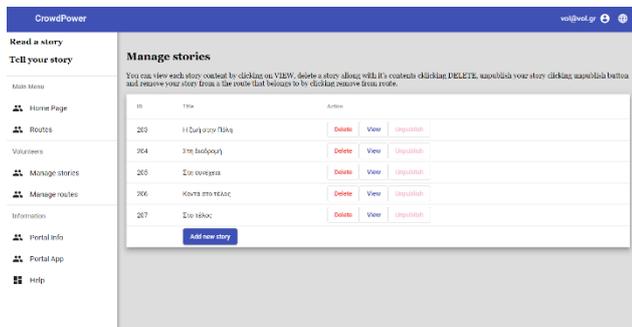


Fig. 4. Portal: Manage stories section.

In section “Manage Routes” a volunteer can create his/her own routes by clicking on the “Add new route” button. In Fig 5. the user has already started this procedure. At this point he/she is asked to put the basic information of the path (name and description). After completing the process, the path is posted to the user's account. In the same way the user can enter as many paths as he wishes. Paths appear in a list, and the user can perform the tasks of deleting and adding stories accordingly.

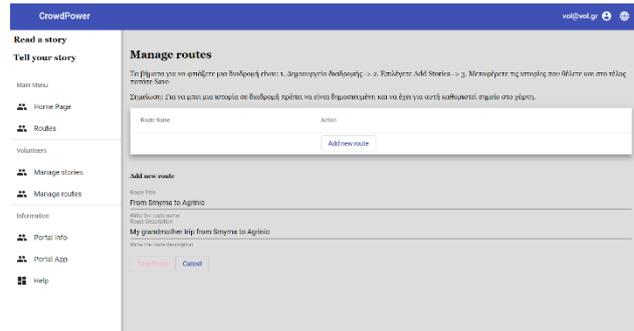


Fig. 5. Portal: Manage route section.

6. Evaluation

A first evaluation was conducted comparing the implemented features regarding routes of the proposed ECP to other systems that are dealing with stories or collective memory. Services and basic features comparison are presented in Table 3.

Table 3. Services and basic features comparison of S1 [21], [22], S2 [30], [34], S3 [23] and the ECP

Services and basic features	S1	S2	S3	ECP
Stories are contained in routes	✓			✓
Stories are related to a moving population			✓	✓
Routes are made to present a comprehensive narration				✓
Routes are presented as flows on a map				✓
Routes are easy to be created	✓			✓
Routes are for trip planning or suggestion	✓	✓		
Point (story) details are easily accessible	✓	✓	✓	✓
Points (stories) are uploaded by users	✓	✓	✓	✓
Routes are filtered	✓			✓
The system promotes learning	✓	✓	✓	✓

The S1 system is not focused on refugees or migration groups but deals with all history periods of Denmark [21], [22]. Also, routes can be created by users using the points of others to plan or suggest a trip to that point. Finally, routes in S1 are not presented as flows on a map. S2 is a system that deals with the sharing of personal memories that interact with the collective city memory [30], [34]. In this context, stories are called memories, placed on a map and are not contained into routes. The S3 system, called Historypin, does not contain the route concept but instead it facilitates the creation of collections of pins [23]. Although the system is not dedicated to moving population, we discovered that it contains related material. The ECP system implements the majority of the services offered in S1, S2 and S3. Having at its core routes and stories, ECP focuses on the dissemination and management of routes that carry collective memory.

Furthermore, to evaluate the system from the user perspective, we adopt a method by Lewis et al. known as cognitive walkthrough [37], [38]. There are two phases in this method: preparation and evaluation. In the preparation phase there is a need to determine a set of representative tasks that the application is to support. We selected the tasks of the basic usage scenario because they can be performed by implemented system services. In the second phase, a small number of specialists (three in our case) from fields related to cultural heritage, graded each user action. Grades varied from 0 to 4 using 0 to indicate

the absence of a user action. The grades 1 to 4 correspond to the familiarity of users towards specific action (this indicates the percentage of users). Four is the maximum percentage. In this evaluation, the target systems are: the ECP, the S1 portal [25]

and the S2 system (1001 stories of Denmark) that is discussed in [21], [22]. Table 4 contains the evaluation results. The implemented ECP system seems to get the highest score.

Table 4. Walkthrough evaluation

	ECP			System 1			System 2		
	E1	E2	E3	E1	E2	E3	E1	E2	E3
User can									
Have an overview of the routes contained by the system	4	4	4	2	3	2	2	3	3
Easily access route information	4	3	4	3	2	2	3	2	3
Upload stories and create a route	4	4	4	2	2	2	4	3	3
Manage a route that has already submitted	4	4	3	0	0	0	0	0	0
Change roles (from viewer to volunteer)	4	4	4	0	0	0	3	2	3
Access an interactive map	4	4	4	2	1	2	4	3	4

7. Conclusions and discussion

This paper focuses on refugee route management, preservation, and dissemination services through mobile or desktop interfaces. The host system is a crowdsourcing collective memory management system that handles different types of users from refugees and their descendants to the general population and specialized users. Crowdsourcing applications and systems have been used to collect data from groups of people in the field of cultural heritage and particularly for collecting people's memories. Using maps to present information regarding the flows of the refugee population is not something new. Although, as far as we know, this is the first system that uses an interactive map to automatically present the routes of a refugee population indicating the flows using content provided by volunteers.

We believe that the designed services are a first step towards preserving the collective memory of refugee populations concerning their related tangible and intangible cultural heritage. The enriched system with the route services supports the sustainability of urban environments that host refugee populations, facilitating the understanding of different cultural identities and improving social cohesion. Apart from that, such a system can be used in the classroom in subjects such as history and sociology. Issues such as the investigation of the impact of wars on populations, the understanding of changes in the societies and the structure of the places where refugee groups remain are some examples. A point worth noting, is the crowd participation and engagement in CS projects. Regarding the system, the ease of use of the services (according to the evaluation), the design that promotes the exchange of ideas with other people and the memory sharing among people, creates a dynamic social ecosystem that may facilitate the volunteer engagement to the system. Finally, the use of interactive maps may facilitate the use of the system by people interested in the specific CM and the contained stories.

There were many obstacles during the creation of the system. First, a critical point is the involvement of volunteers in the content acquisition. Due to the covid situation we could not engage many volunteers that would put a sufficient number of stories and routes to the system. Also, for the system implementation, we used open-source technologies. We may have proven that this process is feasible, but we should mention that it requires a lot of programming time.

In the future we plan to fully implement all services for both mobile app and portal to investigate the users' preferences and concepts like usability, design, system performance and content

when dealing with complex cultural services. We plan to add a layer of historical data on the map not only to assist the user to understand the story context, but also facilitate the learning procedure. Also, the system can be enriched with recommendation services for trip planning suggesting places loaded with memory. Finally, we plan to use the system targeting groups of people with different needs. For example, the system could be used in a city context creating routes within a city based on the CM of the local citizens.

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