59
Review paper
Doi 10.61892/stp202401069P
ISSN 2566-4484

Charikleia Pagouni, National Technical University of Athens, chara.pag@gmail.com
Dimitrios Anastasiou, National Technical University of Athens, danastasiou@mail.ntua.gr
Athanasia Liberi, University of West Attica, geo18391079@uniwa.gr
Eleni Vouklari, University of West Attica, evouklari@hotmail.com
Vassilios Pagounis, University of West Attica, pagounis@uniwa.gr

GEOSPATIAL TOOLS FOR THE STUDY AND DOCUMENTATION OF THE COMMUNAL CULTURAL HERITAGE IN MOUNTAINOUS AND ISOLATED AREAS. THE CASE STUDY OF DOLO POGONIOU

Abstract

This paper outlines a method for researching and recording heritage in remote mountainous regions, using the Municipality of Pogoni, Community of Dolo, Greece, as a case study. It details the documentation of various monuments with high accuracy and precise 3D rendered models. Emphasizing the importance of preserving cultural heritage in remote areas, geospatial technologies are integrated to understand artifacts and traditions. The "GeoDolo Portal" provides access to educational and historical content on architectural structures. The findings underscore the importance of geospatial tools in enhancing the documentation process and fostering community engagement for sustainable heritage conservation initiatives.

Keywords: GeoSpatial data, 3D laser scanning, cultural heritage, communal cultural practices, Municipality of Pogoni, pentatonic routes

ГЕОПРОСТОРНИ АЛАТИ ЗА ИСТРАЖИВАЊЕ И ДОКУМЕНТОВАЊЕ КУЛТУРНЕ БАШТИНЕ ЗАЈЕДНИЦА У ПЛАНИНСКИМ И ИЗОЛОВАНИМ ПОДРУЧЈИМА. СТУДИЈА СЛУЧАЈА ДОЛО ПОГОНИОУ

Сажетак

Овај рад представља метод истраживања и документовања баштине у удаљеним планинским регионима, користећи општину Погони, заједницу Доло у Грчкој, као студију случаја. Детаљно се описује документовање различитих споменика са високом прецизношћу и прецизним 3Д моделима. Наглашава се важност очувања културне баштине у удаљеним подручјима, уз интеграцију геопросторних технологија ради разумијевања артефаката и традиција. "ГеоДоло Портал" пружа приступ едукативном и историјском садржају о архитектонским објектима. Резултати истраживања истичу важност геопросторних алата у побољшању процеса документовања и подстицању ангажовања заједнице за иницијативе одрживог очувања културне баштине.

Кључне ријечи: геопросторни подаци, 3Д ласерско скенирање, културна баштина, културне праксе заједница, општина Погони, пентатонске руте

1. INTRODUCTION

A country's cultural heritage is an integral part of its history, and its promotion contributes to the preservation of its national identity. Today, advanced societies have as their main concern the protection of cultural assets with a spatial dimension, i.e. immovable monuments and sites, their preservation and promotion. The management, protection, conservation and restoration of cultural heritage is achieved through its documentation, which creates the primary basis for its preservation. Recent developments in 3D documentation and technologies in general, have contributed significantly to the digital preservation and dissemination of cultural heritage. 3D models of cultural heritage are now a critical component in heritage conservation. They include the geometric documentation of archaeological sites in their entirety (earth surface and fixed objects), in order to record, evaluate and represent spatial information.

Many questions are raised for the multiple ways and methodologies concerning cultural heritage preservation, especially having to do with the relations developed with tourism. It is here proposed, that the main focus of the previous mentioned task, should have the concept of the community at its core.

In the age of digital-communication globalization, cultural activities serve as vital means for safeguarding, preserving, and advancing cultural heritage, alongside fostering contemporary cultural expressions. These activities encompass the production of cultural artifacts, materials, and intangible experiences accessible to the wider public. Geospatial technology as a crucial player in the realm of arts and culture, particularly in the preservation of cultural heritage [1]. Geospatial tools have revolutionized the preservation, exploration, and understanding of cultural heritage across the globe. Through the integration of Geographic Information Systems (GIS), remote sensing technologies, and advanced mapping techniques, researchers and cultural heritage experts can meticulously document, analyze, and interpret historical sites, artifacts, and landscapes [2], [3]. Geospatial tools offer a multidimensional approach to cultural heritage management, enabling the creation of detailed maps, 3D models, and virtual reconstructions of heritage sites, thereby providing invaluable insights into their spatial context and historical significance [4]. These tools facilitate not only the conservation of tangible heritage but also the documentation of intangible cultural practices, languages, and traditions, enriching our understanding of diverse cultural landscapes and promoting intercultural dialogue and appreciation. A notable application is evident in UNESCO World Heritage Sites, where geospatial tools offer significant advantages. Leveraging high-resolution satellite imaging and advanced 3D scanning techniques, researchers can construct intricate virtual models of these sites, facilitating comprehensive documentation and analysis. In times of natural calamities or human-induced damage, these digital replicas serve as invaluable resources for restoration endeavors. Presently, culture flourishes dynamically across two interconnected yet distinct landscapes: the physical realm and the digital domain. This dual growth fosters the evolution of culture in both spheres, creating conducive environments for the establishment of local, regional, and global cultural policy networks [5], [6], [7]. Furthermore, geospatial technologies play a crucial role in mitigating risks and addressing challenges faced by cultural heritage sites, including natural disasters, environmental degradation, and human-induced threats. High-resolution satellite imagery and LiDAR scanning enable the identification of potential risks to heritage sites and assist in developing strategies for their protection and conservation [8]. Geospatial analysis helps monitor changes in land use, detect illegal activities, and assess the impact of climate change on cultural heritage sites, thus empowering decision-makers and heritage managers to implement informed conservation policies and sustainable management practices. In essence, geospatial tools serve as indispensable assets in safeguarding our shared cultural heritage for future generations and fostering a deeper appreciation of our diverse cultural identities and legacies [9].

Architectural heritage refers to the built environment, structures, and artifacts that provide a tangible link to history and reflect the evolution that took place in a specific place and period of time. Studying of the architectural heritage is fundamental to understanding the achievements and lifestyle of previous civilizations as well as gaining knowledge of the structural techniques, social dynamics, and technological achievements of a particular era [10]. To begin with, the way a small village or a bigger urban environment is planned takes into account social, economic, environmental, cultural, political, moral, and aesthetic aspects of space organization. It is common practice for the urban environment to be organized around some central buildings that house community functions, such as a town hall, a school, or even the central square where people can gather together. Local people’s residences are usually placed around the above. Some buildings house specific occupations, craftsmanship, and workshops where local craftsmen develop their art and constructions such as

bridges, aqueducts, watermills, etc. that indicate human intervention in nature to facilitate its own daily needs and movement. Moreover, the existence of churches and chapels in the area indicates the religious conviction, cultural and traditional practices of the inhabitants. Finally, the morphological features of each building reveal not only the form but also the local materials used based on the environment we study, the means and methods of the construction process, and the financial surface of the locals.

While in past historical periods, the community, in those rural mountainous areas we study - and its cultural imprint - was geographically located and limited to one place, in contemporary reality, it is disconnected from the narrow geographical boundaries of a place or area and is progressively denationalized [11]. In the inquiry for criteria for the definition of modern communities, cultural practices are used as an identification tool of the fluid spatial imprint of community relations, including social, customary, and symbolic processes in a certain field of culture. Through the example of Dolo, the role played by polyphonic music as a capacitor of the community-place relationship will be explored. The previous line of thought aims to document the importance of place and landscape in the context of contemporary rural communities and research the transformations they and their collective memory have undergone. This methodology contributes to the study and reinvention of place - and the landscape as its organic part - in today's society.

Three-dimensional (3D) spatial data is a three-dimensional mathematical representation of natural and human real-world objects on a map, an image, and a scene with height values (zvalues), stored with geometric information [12]. 3D spatial data modeling are series of processes that use the spatial interactions of spatial characteristics to imitate real world circumstances within a GIS [13]. Digital documentation with different technologies as a means of the preservation and safeguarding of a cultural heritage site is based on retaining the image of its status so that probable future deterioration may be reversed on the basis of the visual and three-dimensional digital data already gathered [14].

2. DOLO POGONIOU

2.1. GEOGRAPHY AND HERITAGE

Pogoni is a border region separated by the Greek-Albanian border, with a part of the wider area belonging to the prefecture of Ioannina, Greece, and the rest to Albania (Figure 1). Pogoni is located at the northwestern edge of Ioannina prefecture, between Zagori, Konitsa, Deropolis, Kurenton and Thesprotia. The area belonging to the Greek side is gradually being abandoned with most villages being sparsely populated or abandoned (Figure 2).

The entire territory of the area of Pogoni is made up of mountain clusters, narrow valleys and gorges, as well as small areas of grassland and pasture. The repetition of these geomorphological formations gives the area the geographical form of a homogeneous area, which also has clear natural boundaries. The area of Pogoni is bounded by Drinos and Gormos rivers and by Nemertska, Tsamantas, Kasidiaris and Makrykampos mountains (Figure 3).

Dolo is located on the border of Greece with Albania, 39° 59′30′′ North, 20° 26′ 29′′ East and 800m height, in an area of special natural beauty. It is 70 km NW. from Ioannina and 38 km NW. from Kalpaki (seat of the Municipality).

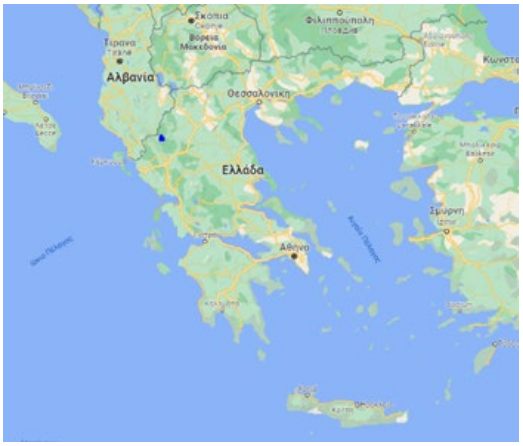


Figure 1. Location of Dolo Pogoni [15]

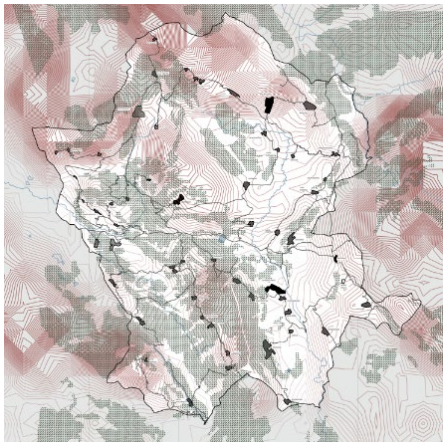


Figure 2. Map of the region of Pogoni [21]

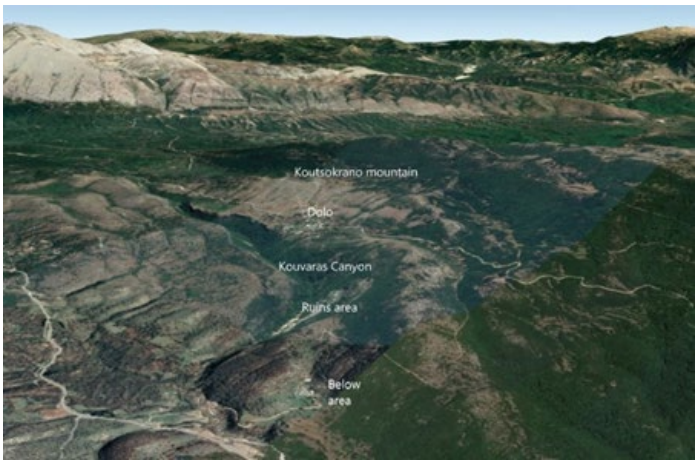


Figure 3. 3D Representation of the wider Dolo area [16]

Dolo - its first name is considered from the oral tradition to be д о л (in Slavic) which means something low and low compared to its high mountain range - is located on the sidewalks of the mountain complex called Koutsokrano and below the hill of Agios Christoforos. The old settlement may have been in the place that is now known as *"χαλάσματα"* (ruins) and which before it subsided would be level with the slope *"παρακάτωνα"* (below). In 1030 mentioned "country of Dolo" in the list of donors of the Monastery of Panagia Molyvdoskepasti [17].

The main occupations of the residents were livestock farming, agriculture, and logging, as the village is located in a wooded and secluded area, far from thoroughfares and influences. In the early 20th century, the population of the village was estimated to exceed 300 inhabitants. The village had a school in the central square (Figure 4), which still exists, initially built in 1824 and relocated to the upper part in 1950. Additionally, the central church of the village was located there, built in 1812, and it is still preserved today with some minor modifications.

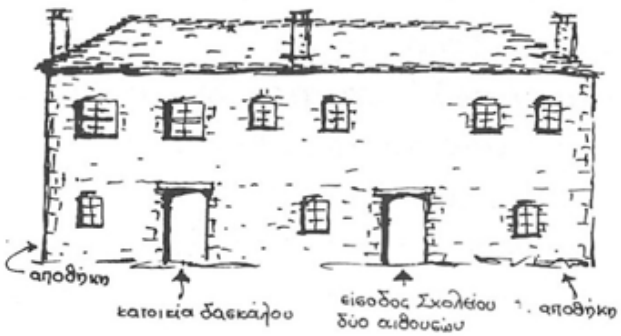


Figure 4. Plan of the first school where, in addition to the two classrooms (είσοδος σχολείου δύο αιθουσών), the teacher's residence (κατοικία δασκάλου) with storage (αποθήκη) can be seen [18].

Each household had its animals, herds next to the house, and fields in various areas around the central settlement. Each family was to some extent self-sufficient in basic products. This characteristic was reflected in the layout of the settlement. Despite the number of inhabitants, the settlement was sparsely populated and geographically spread out. Most houses had a courtyard, which, as an extension of the house, was surrounded by a stone fence and a gate (Figure 5). This means that each house was at a considerable distance from the others, as beyond the residence, at the boundaries of the property, there were auxiliary spaces such as a barn, one or more stables for animals (goats, cattle, horses, etc.), and cultivated plots for basic vegetables [19].

Figure 5. Typical house entrance with a wooden door [18]

The main building, usually a two-story structure made of stone and wood, had a supporting structure of stonework hewn with lime plaster, and the floors were wooden on wooden beams. The roofs of the houses consisted of wooden shingles with a final covering of stone slabs. The internal walls were usually made of "tsatma" (wooden planks), while others were made of "bagdati" (woven wood). Externally, the houses appeared simple and unadorned with clean rectangular volumes, but internally, according to residents' testimonies, they were particularly luxurious with wooden stairs and elaborately carved wooden furniture and other woodwork, depending on the taste of each owner.

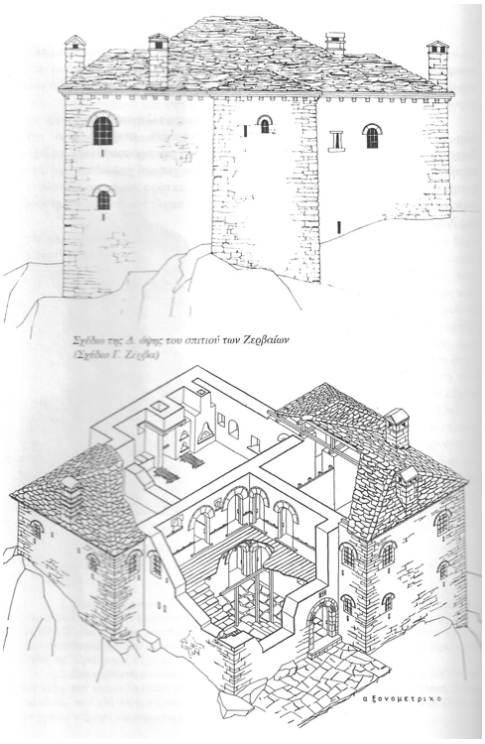


Figure 6. West front view and axonometric plan of the Zervas' house [18]

The layout of the spaces in the two-story buildings usually had auxiliary spaces on the ground floor (storage spaces, kitchen, etc.) and bedrooms on the upper floor, which were sometimes arranged as reception areas. For heating, either fireplaces were constructed, or wood stoves were used (Figure 6).

There is a dependent relationship between community and landscape, in the sense that in earlier years, productive activities were directly linked to it. The family home was both a residence and the center of the productive unit that the family itself constituted. All the families had some sheep and chickens, usually, in their house backyard, while many of them were breeders, by profession,

keeping flocks. Other than that, the rocky and largely barren land of Pogoni made life, extremely, difficult and the standard of living, significantly, low.

There were close community ties, who were reflected in the solidarity and mutual aid between the villagers. In Dolo of Pogoni (as perhaps in other places) the village maintained a 'communal' flock: the shepherd rotated for each day of the week and the flock was the sum of the few domestic animals (sheep and goats) of each family in the village. Religious ceremonies and rituals also played a key role in the formation of the community. The festivals and celebrations in the various villages of Pogoni were -and remain nowadays in a different form- the customary practices of great importance for the reproduction, constitution and cohesion of each community (Figure 7).

It was an expression of the continuity of the past with the present and the future, in the sense of repetition from year to year. The interdependence of place-landscape-community is also reflected in the chronological sequence of the festivals with the completion of some agricultural work, such as harvesting, sowing, etc.

But apart from the annual religious festivals and special occasions, which constituted the "sacred time of the community", a coherent role and common cultural practice for the villages of Pogoni was the polyphonic singing, which was fully interwoven with life itself, and constituted the "daily time of the community".

Figure 7. Map of the region of Dolo [21]

For the construction of the 3D models of the buildings and churches that are included in the platform, a series of technical procedures for data collection need to take place. Initially, the fieldwork implements geodetic and surveying techniques to set up the geodetic infrastructure for the georeference of the digital models and all the products in the platform. The laser scanning of the monuments then follows that will produce the necessary point cloud data and the resulting digital models.

Initially, for the geodetic control of the project, a geodetic network comprising 18 benchmark points around each village were established in the area (ex-municipality of Pogoniani, 6 on Pogoniani, 4 on Stavroskiadi, 3 on Drimades and 4 on Dolo). These points are used to support the field measurements and the georeferencing of all data and form a geodetic infrastructure that will facilitate additional work in the future.

The 3D data collection involved the use of terrestrial laser scanning for the geometric documentation of the external and internal parts of the heritage spots (Figure 8). The scanning was performed using the Leica Geosystems BLK360 image laser scanner (https://leica-geosystems.com). All scans were performed with a 4 mm step and the distance between the object and the scanner was always less than 10m. The percentage of the scan overlap ranged from 30% to 40%. The collected point clouds were processed in proprietary software (Leica Geosystems Cyclone). The alignment of individual scans was performed using tie points in an independent reference system. Regarding the accuracy of the merged point cloud, the mean square error (RMS) ranged from 1 to 1.3 cm. From the merged point cloud, a number of products were created including the meshed model and the ortho-photo models with texture (e.g. RGB, gray scale etc) as seen in Figure. 16 . When all 3D models were created, they were imported into the platform with suitable software offering interactive measuring tools. In this work, the proprietary Leica Geosystems TruView Enterprise software was used where the online user can browse inside and outside the churches, choose to browse through different layers (such as RGB, IR, HDR, Intensity Grayscale and Intensity Hue Layer) and take distance, angle and temperature readings.

Figure 8. Snapshot of the scanning process (left) and example of a point cloud output (right).[Authors]

The heritage of Dolo:

- **Polyphonia:** Epirotic music is based on the pentatonic scale and is divided into instrumental and vocal music, i.e. music played with instruments and simply sung music. Polyphony (Greek word stands for a style of musical composition employing two or more simultaneous but relatively independent melodic lines), whose roots are lost in time, is a strong element of the intangible cultural heritage of Epirus and Pogoni, within and outside the borders (Figure 9). The polyphonic song was an element inscribed in inhabitants' life and their daily activities, being at the same time a collective/participatory process. Polyphonics are sung by groups of people, each of whom has their musical role, precisely defined. 'Partis' is the main singer, 'Giristis' (twirler) follows and sings a melody different from the main singer, 'Richtis' participates in certain parts of each piece and the equalizers, who are usually at least three people, hold the equal, i.e. a standard note. Each voice is developed in unison with the others, while all of them "compete" musically to contribute to the consonance [20]. Polyphonic singing was a way of expression and, at the same time, a way of communication, socialization and interaction between people, the constitutive element of which is the fact that it is a group expression. Nowadays, correspondingly with the dissertation of Pogoni, the footprint of cultural heritage has been descending.
- **Watermill and bridge of Nonoulo**: Just before the settlement of Dolo there is a watermill (Figure 10; 13) and a traditional stone bridge, called the Bridge of Nonoulo (Figure 11).

They are located at the entrance of Kouvaras canyon. The canyon is crossed by the Gormos river which used to supply water to the watermill for its operation. The bridge was built at the expense of an active Pogonian woman named Nonoulo, from whom it bears its name and connects Dolo with Pogoniani through a path. The bridge is a stone single-arched bridge and was built in the early 20th century (1908). It is 6 meters high, while its opening arch is estimated to be 7m. The length and width of the bridge deck are 9.40 and 2.70 (1.80 internal) meters respectively (Figure 12). A low parapet has been built on the sides of the deck, which further ensures a comfortable and safe passage. The bridge is an ornament of folk architecture for the area, which records on the one hand the local folk architecture and the pre-industrial era.

Figure 9. map of the density of the remaining cultural practices remaining in the Pogoni region (dark blue) in comparison with the early 20th century (light blue) [21].

Figure 10. View of the water mill and the stone bridge of Nonoulo in the background [Authors]

Figure 11. The stone bridge of Nonoulo [Authors]

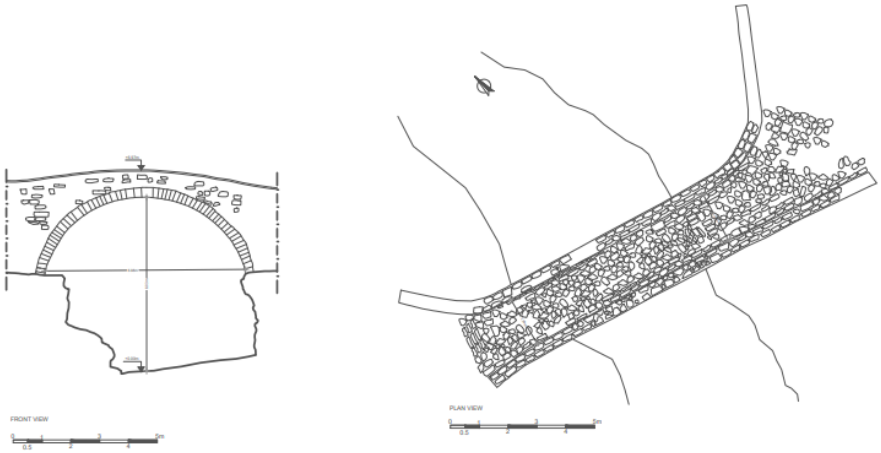


Figure 12. Drawings of Nonoulo bridge [Authors].

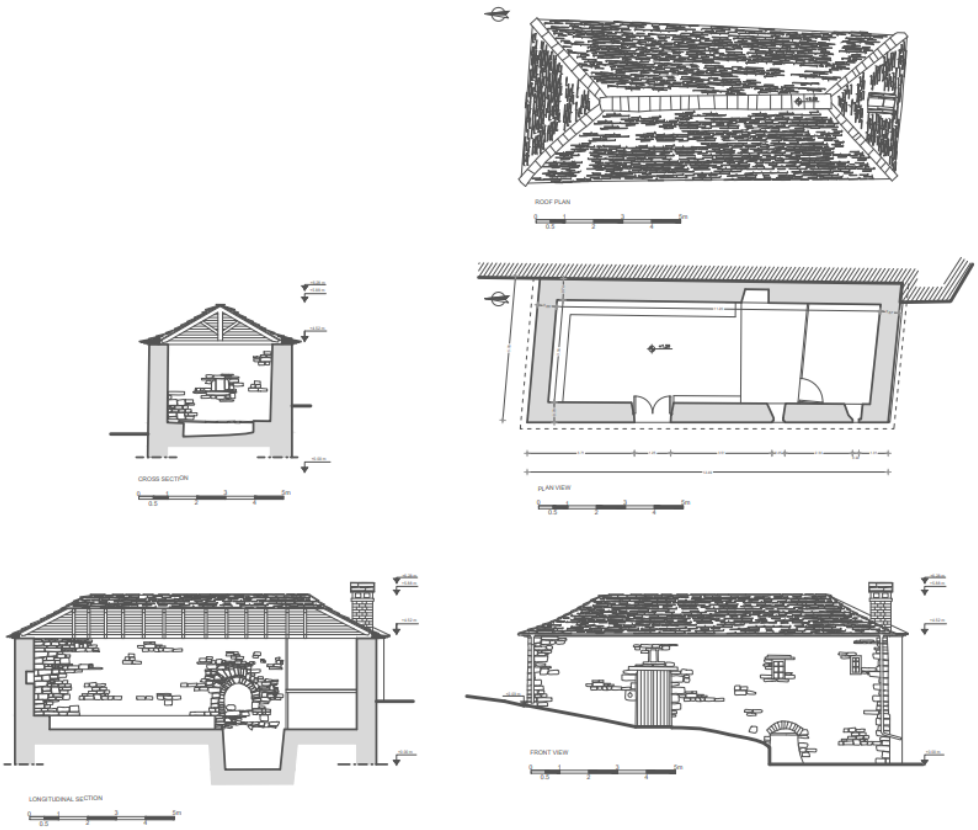
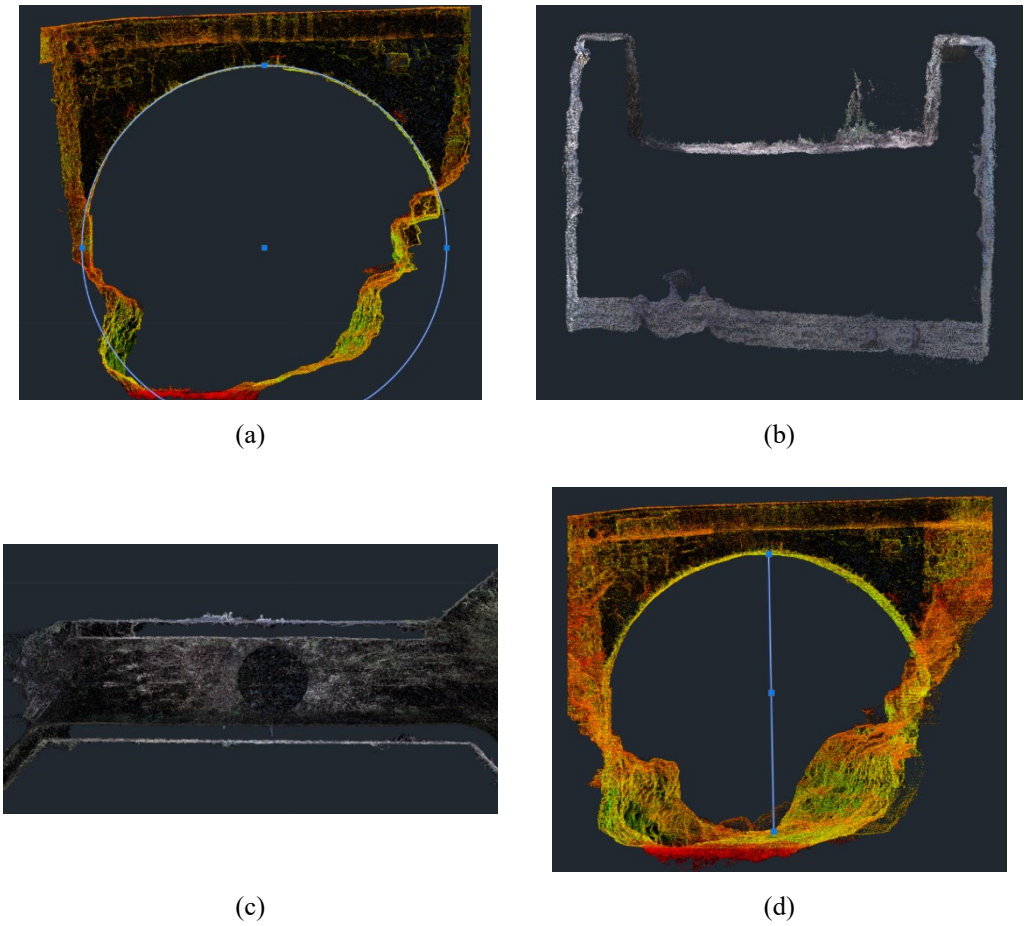


Figure 13. Drawings of watermill [Authors].

- **Kouvaras bridge**: This is a stone single-arch bridge that spans the Kouvara stream (Figure 14). The bridge was built in 1926 and is located northwest of the settlement at the point where the path from Dolo passes through the gorge, under the icon in Tchoubari, towards Pogoniani at an altitude of 780 meters. It was built at public expense by the master builder Paschalis Zounis (1898-1988) from Pyrsogianni (Konitsa). The arch has a span of 7 meters and a height of 6.5 meters. The total length of the bridge is 7.80 meters (Figure 15). The original stone pavement is preserved, and the protective parapets have been repaired.

Figure 14. Photos of Kouvaras bridge



(a) (b)

(c) (d)

Figure 15. Construction components for Kouvaras bridge (a) adjusted circle, (b) Section of the pavement, (c) top view and (d) arc height [Authors].

- **The churches of Dolo**: In Dolo there are 7 chapels (Agios Christoforos, Agios Dimitrios, Agia Triada, Agios Giannis -Cemetery, Agios Georgios, Agios Nikolaos, and Ai Lias) and the central church of Agios Nikolaos.

Central church of Agios Nikolaos. The church is located in the central square of Dolo, right next to the café and is one of the most beautiful churches in Epirus (Figure 16). The holy church was built in 1812 and is of the three-aisled basilica type. It has a large, integrated two-zone bell tower on its south side. The building is made of stone, is spacious and has small windows. The windows had the same dimensions until 1870 when they were rearranged. The roof of the windows was also altered and changed from an aligned to a Gothic roof. The elegant outdoor areas (loggia) were built at the beginning of the 20th century. To this end, a theatrical performance was held in the village in 1910, the proceeds of which were used to build the choir stalls. However, several interventions were also made to the exterior of the temple in later years, which nevertheless appear harmonious (Figure 18).

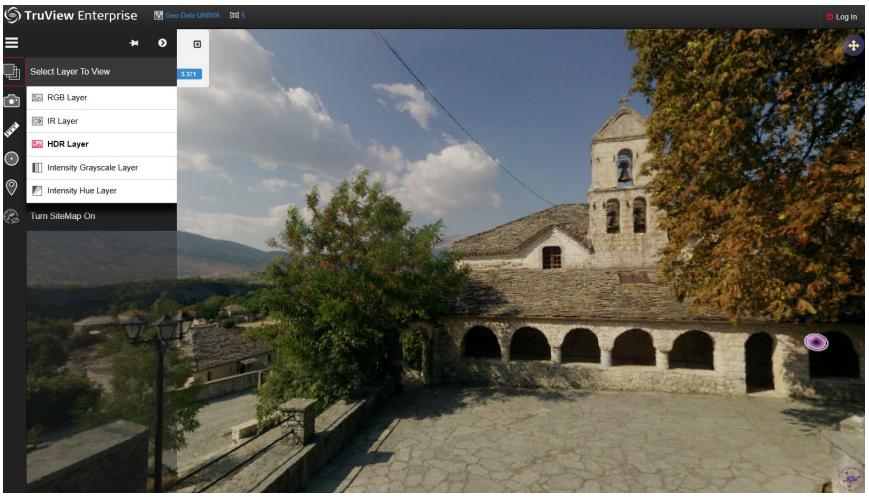


Figure 16. South view of the church of Saint Nicholas [Authors].

Inside, the main church had the following form: the sacred step, which was separated from the iconostasis (templo) (Figure 17) by the andronite, the main church (andronite) and the gyneconite, which was separated from the main church by a stone wall. It should be noted that the wood-carved iconostasis of the church was designed by the painter Haris Mexis (who comes from Dolo) and occupies the width of three naves. The general design generally follows the form - architecture, technique, and aesthetics of the elaborate post-Byzantine iconography. The oldest frescoes in the church are the work of the painter Kouros also comes from Dolo).

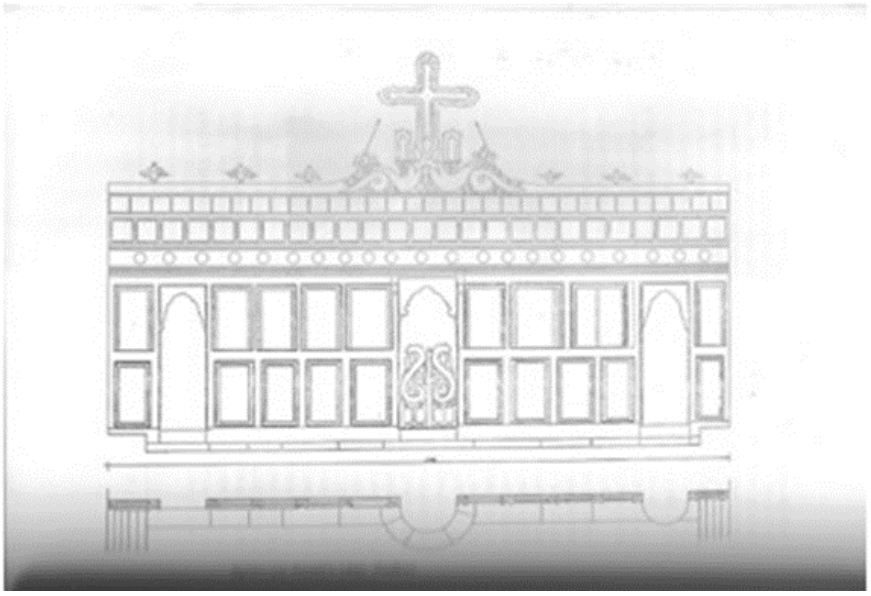


Figure 17. Drawing of the iconostasis [18]

The double bell tower of the church, built of stone, was erected a few years later, in 1830 to be precise, by Paschalis Zounis, an archmason from the neighboring village of Pogoniani. The dimensions of the bell tower are 10.40x2.60 meters.

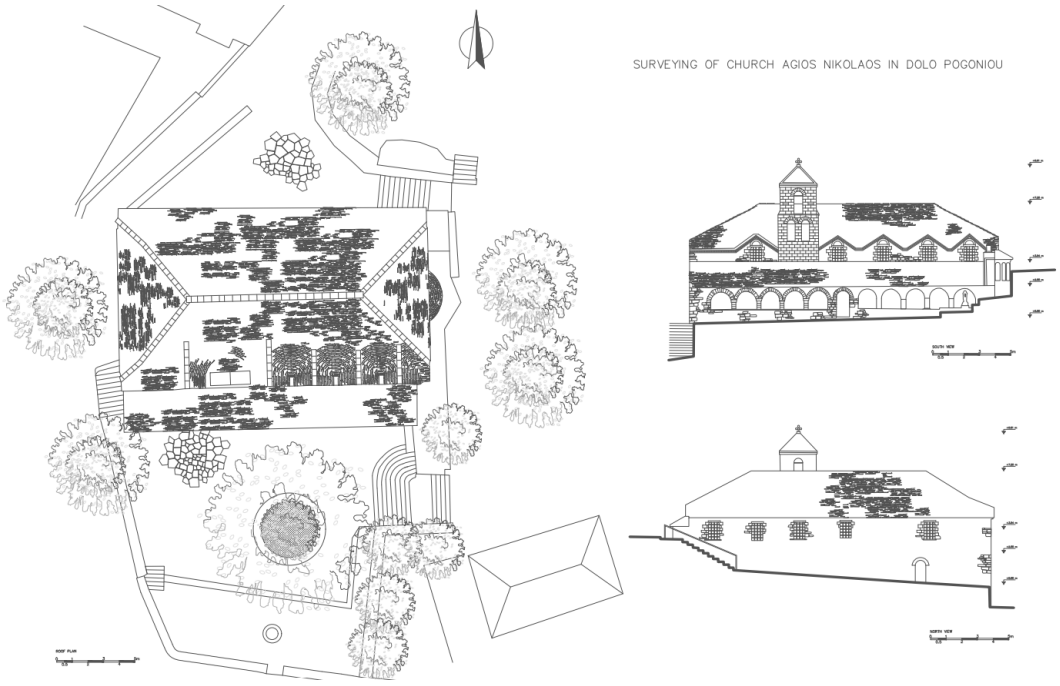


Figure 18. Surveying of church Agios Nikolaos in Dolo Pogoniou [Authors].

2.2. PENTATONIC ROUTES AS A COMMUNITY SPATIAL IMPRINT AROUND THE CHURCHES OF DOLO

In almost every village, there are some annual celebrations related to religious ceremonies and local traditions. These celebrations are also cultural practices bonding the community, thus, while they are practiced, produce a spatial imprint. The most characteristic example is the celebration of Aghios Christophoros, a saint "protector" of Dolo, whose chapel named after him is placed on the top of Koutsokrano mountain, above the village (Figure 19). Every year, on the 9th of May, all villagers in Dolo, wake up early and have the one-hour walk towards the chapel, where a church service takes place. It is a custom also for the elders of the village to follow that route, to attend the service. Afterwards, they return downhill to their final destination the village's square. In the "entrance" of the village a traditional music group (kombania) waits to accompany the community to the square. There is a whole part of musical tradition concerning the songs that are sung while walking (*δρομικά τραγούδια*, in greek) and the case of Aghios Christoforos is only one example of that. Up until the 80's the above-mentioned party (musicians and villagers) used to make a halt to every house that a Christopher lived in, celebrating each member of the community in their houseyard with music, dance, tsipouro (traditional drink), and food (kerasma). When that part of the celebration was over, the party ended up in the village square with the customary panighiri, where they drank, danced and celebrated.

That analyzed root can easily be called a cultural practice, that is part of the sacred time of the community and interweaves the cultural heritage (pentatonic music) with the place itself. The root seems to have a spatial imprint, as there is a specific song that matches with a specific landmark of the path. The music plays an important role during the house-celebrations as well, giving a chance to each villager to express his individuality through communal practice.

Figure 19. Root form St. Cristophoros church to Dolo Village [21]

3. DEVELOPMENT OF GEODOLO PORTAL

The GeoDolo Portal is a geographical information map that was developed to promote the cultural heritage and traditional polyphonic music of Dolo region and it is freely accessible (http://195.130.106.60/GeoDolo/). It was developed using exclusively Free and Open Source Software (FOSS). The applications that were used are given in Table 1 with their respective releases and licenses.

Data stored in the database are available through a server that supports the Web Map Services (WMS) standard for versions 1.1.1 and 1.3.0. The WMS is accessible at http://195.130.106.60/geoserver/dolo/wms where all available information can be retrieved. The GET SDI Portal v4.0 mapping platform (https://github.com/GeospatialEnablingTechnologies/GET-SDI-Portal) was used to disseminate all available data to citizens and **the** scientific community. This mapping platform, developed by Geospatial Enabling Technologies (http://www.getmap.gr), was based on **open-source** projects and is available under the terms of the GNU=GPL v3 license.

The mapping layers were grouped into seven basic teams. The following five groups relate to the basic background:

- Administrative borders for Pogoni Region,
- terrain features,
- environment - protection,
- anthropogenic environment,
- heritages,
- churches,
- routes,
- musical tradition.

The portal is constantly being updated when new data are available to the database. A schematic of the design structure of the web portal is given in Figure 20.

Table 1. Free and Open Source Software used to develop the "GeoDolo portal".

Software Package	Version	License
QGIS (http://qgis.com)	3.6.0	GNU-GPLv2
PostgreSQL (http://www.postgresql.org)	10.5	PostqreSQL
PostGIS (http://postgis.net)	2.4	GNU-GPLv2
Geoserver (http:/geoserver.org)	2.15	GNU-GPLv2
GeoWebCache (http://geowebcache.org)	1.14.2	GNU-LGPL
GET SDI Portal (http://www.getmap.gr)	4.0	GNU-GPLv3

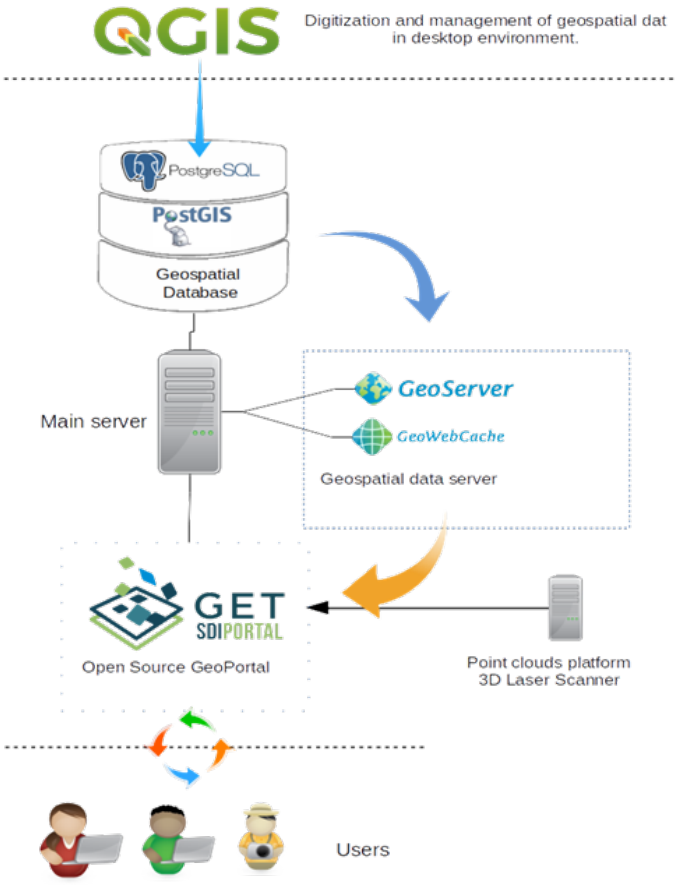


Figure 20. Workflow implementation portal [Authors].

The database that supports the GeoDolo Portal was developed in a PostgreSQL environment to store, share, and easily retrieve the metadata of each thematic layer. The Post GIS extension was used to access the geospatial information of each level. The database was installed on a central server of the Department of Surveying and Geoinformatics at the University of West Attica.

Cultural content in museum collections, libraries, and other content repositories is usually described using metadata schemas (also called annotation schemas or annotation ontologies). These templates specify a set of obligatory and optional elements, i.e. properties, by which the metadata for content items should be described.

The structure of the database includes tables related only to geospatial information such as the digitized contours for the production of the terrain model, relief information, rivers, Natura regions, etc. At a second level, it includes the entities for all the necessary police information that is available through the platform with the corresponding metadata that each user can access. These concern the sites of interest where the geometric documentation of cultural monuments has been carried out as

well as the necessary information for the routes that are created and which each visitor can browse digitally

In its current form, GeoDolo Portal follows traditional portals where the search is usually based on free text search (e.g., Google), database queries, and/or a stable classification hierarchy (e.g., Yahoo!). However, it aims to use semantic content which makes it possible to provide the end-user with more "intelligent" facilities based on ontological concepts and structures, such as semantic search, semantic autocompletion, and (multi-)faceted semantic search (e.g Junnila et al., 2006). In addition, semantic content facilitates semantic browsing and the semantic associations between search objects can be exposed to the end-user as recommendation links, possibly with explicit explanations. Also, other kinds of intelligent services can be created based on machine interpretable content, such as knowledge and association discovery, personalization, and semantic visualizations based on e.g. historical and contemporary maps and timelines.

4. DISCUSSION (INCLUDING LIMITATIONS)

Cultural heritage provides a rich application domain in which useful collection contents are available, and where relevant organizations are eager to make their content easily and publicly accessible. In this work, a portal named GeoDolo Portal has been developed to provide collection content about the monuments of the Pogoni region. Leveraging a geographic platform to highlight cultural heritage can actively and meaningfully involve community members. The use of such a platform offers ways and methodologies for deepening, revealing, recording, examining, analyzing, interpreting, presenting and disseminating information about people, communities, societies, places and material objects and customs related with these. The online platform presented in this paper aspires to be functional, simple to use and scientifically accurate in terms of the data included. The role of the internet in highlighting and promoting monuments and cultural routes is important, especially when geospatial data is used online for smart mobile devices, serving search capabilities to people who love nature and have specific cultural interests. The aim is to use customized solutions to promote cultural heritage as a public good.

Experiences, collective memory and cultural practices are imprinted on space and transform it into a place that is emotionally, empirically and historically charged. This mapping also forms a narrative or many parallel narratives and stories about a place. Community ties, stories, songs, rituals, tales and myths form a collage of experiences and spatial reference points in a virtual map of the place. Modern regeneration and landscape redesign proposals do not seem to always take these criteria seriously into account but, instead, the intention is mainly aimed at fulfilling an economic objective or rather a development objective (decentralized development is development). These economic objectives are accompanied and substantiated by the aforementioned logic of romanticizing non-urban landscapes, transforming rural places in solely a touristic-purposed scenery. In the opposite direction to this logic -of prioritizing tourism needs- the inclusion of the community perspective, i.e. collective experiences, memory, and narratives, is advocated. This can be done in many different ways. The criteria for approaching that design logic surely relates to the reflection a community has in a place and its landscape and vice versa.

Local narratives and their contemporary intakes could be matched with a situational perception of the narrativity of each place. To achieve this, there would be applied art applications using location-aware-technology (which has already started since the early 1990s) making the creation of a digital geoplatform feasible and accessible to the general population. It will collect, using open-source software, data that will capture memory and experience. It will look like a map, on which all the points, where a story or a song from the local folk narrative is mentioned, will be marked with pinpoints. It will include all the places that were -and still are- community reference points, such as a village square, or places that were -and no longer are-, thus inviting wanderers to reappropriate them through their reuse and re-inhabitation.

In its current form, the GeoDolo portal is not semantic. The portal content has been created in a centralized fashion by using a content management system (CMS). However, it is within the future directions of this work to enhance the portal with semantic properties that will help create and maintain links up-to-date automatically based on the metadata and ontologies and allow the portal content to be reused in different applications and cross-portal systems.

ACKNOWLEDGEMENTS

The publication of the article was fully funded by the University of West Attica.

LITERATURE

[1] S. K. Bhoda, "Geospatial Technology for Arts and Culture: A New Horizon of Interdisciplinary Collaboration," *in Linkedin,* 2023.

[2] G. Droj, "Cultural Heritage Conservation by GIS," in Nyugat-Magyarországi Egyetem, Geoinformatikai Kar, Székesfehérvár, 2010.

[3] L. Tricarico, E. Lorenzetti, and L. Morettini, "Crowdsourcing Intangible Heritage for Territorial Development: A Conceptual Framework Considering Italian Inner Areas," in Land, 2023, vol. 12(10), 1843. https:// doi.org/10.3390/land12101843.

[4] A. Georgopoulos. "3D GEO: An alternative approach," in ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume IV-2/W1, 11th 3D Geoinfo Conference, Athens, Greece, Oct. 20–21,2016,

[5] T. Ocal, "The Effect of Field Trips to Historical Cultural Heritage Sites on Teacher Candidates," in Academic Knowledge and Their Sensitivity. Creative Education, Vol.7, No.2, 2016.

[6] G. Gkntzias, "Cultural Policy, Sponsorship and Corporate Social Responsibility," Ed. Papasotiriou (in Greek), 2010, ISBN13 9789607182135.

[7] D. J. Timothy, and S. W. Boyd, "Heritage Tourism," UK: Prentice Hall, 2003.

[8] M. Shafapourtehrany, M. Batur, F. Shabani, B. Pradhan, B. Kalantar, and H Özener, "A Comprehensive Review of Geospatial Technology Applications in Earthquake Preparedness, Emergency Management, and Damage Assessment," *in Remote Sensing* 2023, vol. 15, 1939. https://doi.org/ 10.3390/rs15071939.

[9] L. Tsipi, D. Vouyioukas, G Loumos, A. Kargas, and D. Varoutas, "Digital Repository as a Service (D-RaaS): Enhancing Access and Preservation of Cultural Heritage Artifacts," in Heritage, 2023, vol. 6(10), 6881-6900; https://doi.org/10.3390/heritage6100359.

[10] Y. Yao, X. Wang, L. Luo, H. Wan, and H. Ren, "An Overview of GIS-RS Applications for Archaeological and Cultural Heritage under the DBAR-Heritage Mission," in Remote Sensing, 2023, 15, 5766. https://doi.org/10.3390/rs15245766.

[11] V. Nitsiakos, "Building Space and Time," Odysseas, Athens, 2003

[12] F. Biljecki, H. Ledoux, and J. Stoter, "Generating 3D city models without elevation data," in Computers, Environment, and Urban Systems, 2017, vol. 64, pp. 1–18. doi:10.1016/j.compenvurbsys.2017.01.001.

[13] M. M. Apeh, and A. Abdul Rahman, "A review of 3D spatial data models for surface and subsurface integration of spatial objects," in Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., 2023, XLVIII-4/W6-2022, 15–23, https://doi.org/10.5194/isprs-archives-XLVIII-4-W6-2022-15-2023, 2023.

[14] E.Stylianidis, E., Evangelidis, K., Vital, R., Dafiotis, P., Sylaiou, S. 3D Documentation and Visualization of Cultural Heritage Buildings through the Application of Geospatial Technologies. Heritage 2022, 5, 2818-2832. https://doi.org/10.3390/heritage5040146

[15] Google. (n.d.). [Dolo, Pogoni in Greece]. Retrieved March 26, 2024, from https://www.google.com/maps/place/%CE%95%CE%BB%CE%BB%CE%AC%CE%B4%CE%B1/@38.5078184,21.1503383,7z/

[16] Google Earth Pro, version7.3. Pogoni, Greece. 39.985505, 20.434408, Eye alt 11049 feet. DigitalGlobe 2012. http://www.earth.google.com [March 26, 2024].

[17] Epirotiki Estia, Monthly Inspection in Ioannina, vol. 170-171, 1966

[18] N. Ifantis, "Dolo in Pogoni, in Excessive Helenism," in Publication of the Cultural Association of Dolos Pogonion, Volume A, 1996.

[19] N. Ifantis, "Dolo in Pogoni, in Excessive Helenism," in Publication of the Cultural Association of Dolos Pogonion, Volume B, 1996

[20] K. Lolis, "The epirotic polyphonic song," 2006

[21] Gkounta, E.; Pagouni, Ch. Music routes. Pentatonia in Pogoni. Diploma Thesis, NTUA, 2021