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HERITAGE AND TECHNOLOGY: THE CONTRIBUTION OF GIS TO THE MANAGEMENT AND ENHANCEMENT OF SETIF'S HISTORIC BUILDINGS

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ABSTRACT

In today's global context, the preservation of architectural heritage is becoming a crucial challenge, particularly for buildings from the 19th and 20th centuries, which are often neglected or underestimated. This study focuses on the city of Setif, Algeria, where a rich architectural heritage bears witness to the region's historical and urban evolution. However, the lack of effective mechanisms for inventorying and promoting this heritage remains a major obstacle. The main objective of this research is to demonstrate the use of Geographic Information Systems (GIS) for the management and enhancement of the built heritage of Setif's historic center. The study explores the use of GIS to create a georeferenced database, facilitating the collection and consultation of detailed information on each building. The methodology includes document collection, georeferencing of buildings and their integration into QGIS software. The results show that such an interactive database enables more efficient management and better decision-making for heritage conservation. The case study of three representative buildings (Ibn Badis mosque, Kerouani high school, and Bank for agriculture and rural development) illustrates the application of GIS in the enhancement of architectural heritage. This approach contributes to the sustainable preservation of Setif's heritage and its integration into cultural development policies.

KEYWORDS

Architectural Heritage, Geographic Information Systems (GIS), Setif, Heritage Conservation, Georeferenced Database, Qgis

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Introduction

Today, in a global context where preserving architectural heritage is becoming a major challenge, there is growing interest in showcasing buildings from the 19th and 20th centuries. This architecture, often overlooked or underestimated, has gradually been recognized for its historical importance, particularly since the 1980s, with the attribution of a specific status to “New Heritage”, including emblematic buildings of colonial and industrial heritage (Bernard, 2012).

In Algeria, after a long period of neglect, interest in this heritage is turning around, with an increase in research into the architecture of Algerian towns in the 19th and 20th centuries (Chérif, 2017). This study is situated within this context, focusing on the historic center of Setif. This city, rich in buildings representative of these two centuries, is a precious testimony to the historical and architectural evolution of the region. However, the absence of effective mechanisms for inventorying and sharing information on these buildings limits their management and enhancement.

In this context, our research explores the use of advanced technologies to overcome these shortcomings. The use of Geographic Information Systems (GIS) aims to create a digital, geo-referenced database of historic buildings in the center of Setif. This interactive tool will enable rapid access to detailed information on each building, which can be consulted at the click of a button, and will facilitate heritage management and preservation by local authorities, in particular Setif's Department of Culture. In addition, GIS will contribute to a better understanding of the distribution of heritage elements across the territory and their geospatial relationships, providing a solid basis for cultural development policies (Granero Gallego, 2017).

The main objective of this study is to demonstrate how geospatial technologies, and more specifically GIS, can evolve to become a tool for decision support, conservation and enhancement of historical and architectural heritage (Acheuk-Youcef, Gauthiez, & Sahraoui, 2019). We will also analyze the implications of creating such a database for the long-term conservation of Setif's heritage.

1.1 Geographic Information Systems

Geographic Information Systems (GIS) are technological tools designed to collect, manage, analyze and represent spatial data. They enable geographic information to be visualized in the form of interactive maps, and complex spatial analyses to be carried out in response to a wide range of problems (Longley;, Goodchild;, Maguire;, & Rhind, 2011).

A GIS is made up of several essential elements:

- Spatial data: Points, lines or polygons representing geographic features (buildings, roads, areas).
- Attributes: Information associated with these elements, such as name, status or function.
- Software: An interface for interacting with this data (e.g. QGIS, ArcGIS).

1.2 GIS applications in the heritage sector

GIS has established itself as an essential tool in the management and enhancement of architectural heritage. Here are some of their main applications:

- Inventory and management: GIS can be used to group and centralize information on historic buildings, facilitating the creation of geohistorical and geocultural databases for rapid and structured access (Gadal, 2010).
- Spatial analysis: GIS offers powerful tools for studying the geographical distribution of heritage buildings and analyzing their relationship with their environment. This capability makes it possible to identify areas requiring priority intervention, particularly in terms of conservation or risk prevention. For example, UNESCO uses GIS to monitor environmental and human impacts on World Heritage sites (https://whc.unesco.org/fr/wh-gis/).
- Awareness-raising tools: Interactive maps make it easier to communicate and raise public awareness of the importance of cultural heritage.
- Decision-making support: They provide decision-makers with tools to help prioritize conservation or restoration actions.

1.3 study context: downtown Setif

Located in northeastern Algeria, Setif occupies a strategic position as a crossroads town, making it one of the major centers of colonization during the colonial period (Bioud & Bouzaher, 2023). Setif's historic center boasts a rich built heritage, bearing witness to the city's architectural and urban evolution. This heritage, appreciated by the local population, is seen as an integral part of Setif's history and collective identity(Bioud & Bouzaher, 2024).

However, this architectural heritage is facing growing challenges, marked by signs of disrepair and increased vulnerability due to the absence of appropriate conservation policies. This study aims to document and enhance this heritage, while exploring the use of Geographic Information Systems (GIS) as a practical and innovative solution for its management. It is part of an integrative approach aimed at strengthening the recognition and sustainable preservation of this heritage.

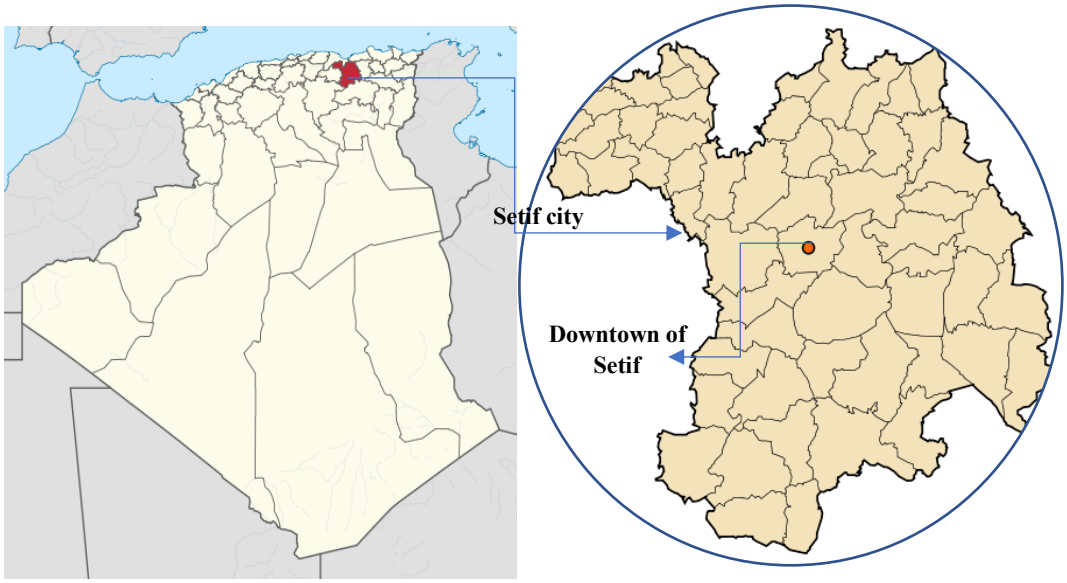

Fig. 1. Location of Setif and its downtown

2. Methodology

This study uses Geographic Information Systems (GIS) to create a digital, georeferenced database of historic buildings in the center of Sétif, in order to inventory, map and enhance this heritage. The methodology is based on three main stages:

2.1 Documentary research and data collection

An analysis of national and local archives enabled us to gather historical data on the buildings. At the same time, field visits were carried out to observe the current state of the buildings and gather information on their conservation.

2.2 Building georeferencing

The buildings identified were geolocated on a map of the historic center of Sétif using GPS coordinates, in order to guarantee their spatial accuracy.

2.3 GIS integration with QGIS

The data collected were integrated into the QGIS software, chosen for its many advantages, notably its free availability, ease of installation, and intuitive interface enabling rapid learning. What's more, its great interoperability with data from other software makes it a suitable tool for managing complex and diversified information (Roussel, 2012). An interactive interface has been developed, where each building can be consulted individually: a simple click on a building displays the detailed information associated with it, offering a convenient experience for users.

Local institutions to manage and enhance their built heritage can use this geo-referenced database.

3. Results and discussion

3.1 Presentation of the georeferenced database

A georeferenced database has been developed on QGIS to inventory and document the historic buildings of downtown Sétif. This database is a tool for centralizing and visualizing key information, facilitating the management and enhancement of local architectural heritage. Each building is associated with a digital file containing:

- General information: original name, current name, building type, date of construction.
- Architectural features: style.
- Multimedia elements: photograph.

- Associated documents: detailed report or description in Word format.

This process made it possible to structure the information in an accessible and interactive way, and to generate enriched cartographic representations.

3.2 Study of three representative buildings

3.2.1 The Iben-Badis mosque (formerly the Eglise Sainte- Monique)

The Ibn Badis mosque, formerly known as the Church of Sainte-Monique, was built in 1867. Originally, the church consisted of a central nave leading to the altar, flanked by two aisles, a choir, two chapels dedicated respectively to the Virgin and the patron saint of the parish, and a sacristy (Centre des Archives d'Outre-mer, Aix-en-Provence, 2N53). The church's main façade featured an entrance porch topped by a bell tower, with a staircase leading up to it.

In 1970, the Sainte-Monique church was converted into the Ibn Badis mosque, preserving many of its original architectural features, including the floor layout, plaza and access orientation. However, several adjustments were made during the conversion, such as the transformation of the aisles from a single-pitch roof to two mezzanines overhanging the main hall, necessitating the replacement of the roof with a floor. In addition, the bell tower was replaced by a cupola on the main façade, and two new minarets were erected on either side of the western part of the transept. The façade was embellished by the artistic application of Zelidj, and concentrated lighting, similar to that used in the old church, was installed.

A screenshot of the QGIS interactive map (Figure 02) shows the georeferenced location of the former church, accompanied by essential information such as original name, current name, type, as well as a link to a Word document containing detailed information on the building.

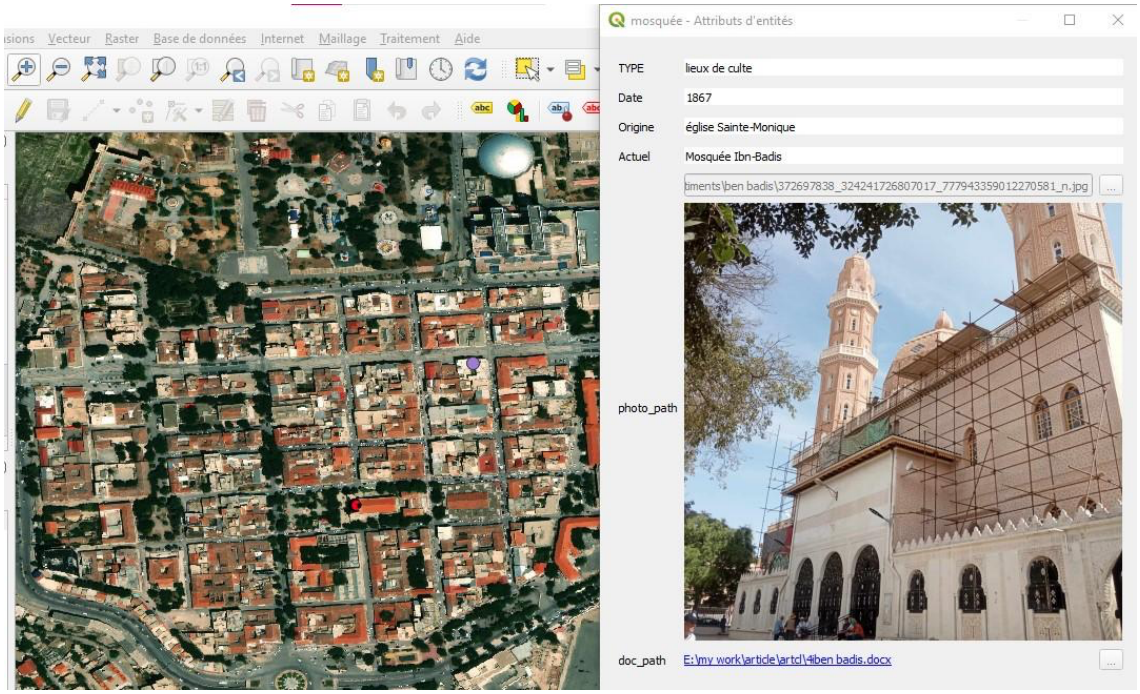

Fig. 2. GIS capture of Iben-Badis Mosque using QGIS

3.2.2 Kerouani High School (former Colonial College)

Kerouani High School, originally known as Colonial College, was built between 1872 and the 1950s. This historic building, a witness to the urban and social evolution of Sétif, has borne several names over the years, becoming Lycée Albertini during the colonial period before adopting its current name after Algerian independence. Since its creation, the building has retained its educational vocation, illustrating a rare functional continuity that reinforces its importance in the town's heritage and educational landscape.

The façade of the Kerouani High School reflects the characteristic architecture of public buildings of the French Third Republic, marked by strict symmetry that accentuates its monumental character. This architectural style is distinguished by modest but significant decorative elements, highlighting its educational

function and symbolic role. In addition, the use of local materials reflects a concern to combine robustness and aesthetics in its design.

Between 2009 and 2022, the establishment benefited from an extensive renovation program designed to preserve its architectural integrity while modernizing its infrastructure to meet contemporary requirements. These interventions have helped to ensure the sustainability of this heritage while respecting its authenticity.

Kerouani High School is thus an emblematic example of Sétif's educational heritage. Its architecture, ongoing role and recent restoration work highlight the importance of preserving historic buildings in a context of urban development. However, a better appreciation of its history and architectural features could help raise awareness of its heritage importance within the local community.

A screenshot of the QGIS interactive map (Figure 03) shows the georeferenced location of the high school, accompanied by essential information such as original name, current name, type, etc., as well as a link to a Word document containing detailed information on the building.

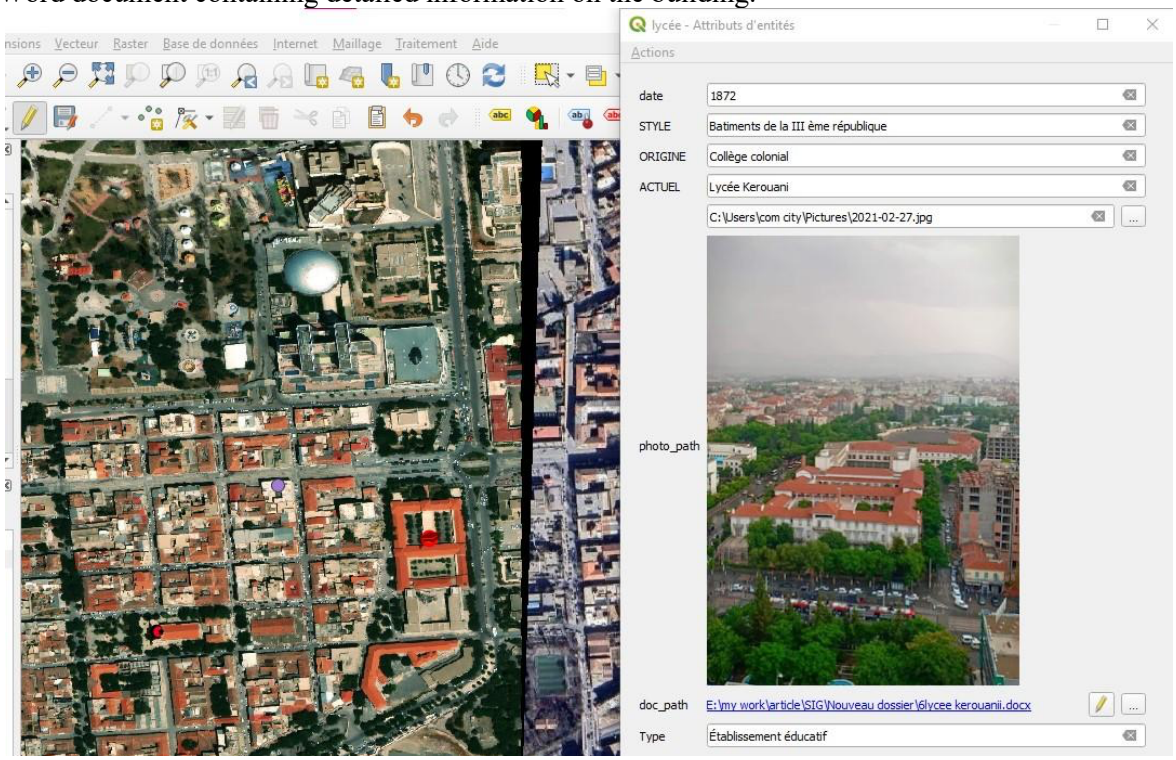

Fig. 3. GIS capture of Kerouani High- school using QGIS

3.2.3 Banque of Agriculture and Rural Development "BADR" (formerly Land credit of Algeria and Tunisia)

The Banque of Agriculture and Rural Development, formerly known as Land credit of Algeria and Tunisia, is a prestigious building constructed between 1914 and 1920. It is based on a reinforced concrete post-and-beam system, used for various architectural elements such as floors, columns, beams and staircases.

The building features a magnificent symmetrical neoclassical façade, rich in decorative elements. It features Ionic pilasters, keyed lintels, a pediment crowning the central section and a molded cornice. The entrance to the bank is marked by an elegant arcade, contributing to the building's impression of grandeur.

Following Algeria's independence, Land credit of Algeria and Tunisia changed its name to Banque of Agriculture and Rural Development, marking an important milestone in the history of the building.

A screenshot of the interactive QGIS map (Figure 04) shows the georeferenced location of the bank, accompanied by essential information such as original name, current name, type, etc., as well as a link to a Word document containing detailed information on the building.

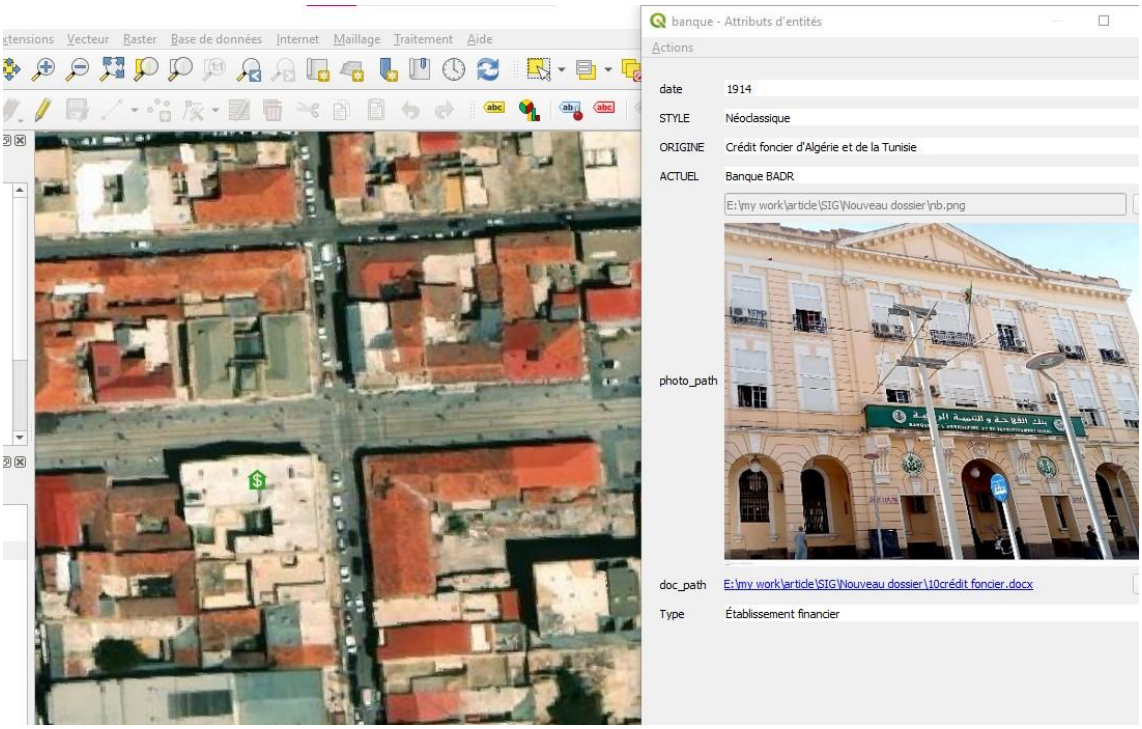

Fig. 4. GIS capture of the Bank using QGIS

Geographic Information Systems (GIS), used in this study, are proving to be a crucial tool for the management and enhancement of these buildings. By enabling the collection, organization and visualization of data related to each building, GIS offer an integrated approach that facilitates conservation planning. The use of interactive maps and geo-referenced databases not only helps preserve the integrity of buildings, but also raises public awareness of their historic value. In addition, they provide local authorities with the tools to make informed decisions about the management of built heritage, by identifying buildings in need of urgent intervention.

4. Conclusions

The study of three emblematic buildings in Sétif - the Lycée Kerouani, the Ibn Badis mosque (formerly Sainte-Monique Church) and the Banque of Agriculture and Rural Development - highlights the importance of these edifices in the city's architectural and social history. Each bears witness to Setif's historical transformations, between colonial heritage and post-colonial adaptation.

The use of GIS has facilitated the management of these buildings by centralizing the information essential to their conservation. However, the preservation of Sétif's heritage requires a balance between urban development and conservation, involving the local community in the enhancement of these buildings.

For future research, it would be pertinent to explore other historic buildings in Setif, to analyze the impact of heritage digitization and to study local perceptions of these buildings. This study demonstrates that knowledge and appropriate management of Setif's architectural heritage are crucial to ensure its sustainability and its role in the city's identity.

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