Artificial Intelligence Revives the Islamic Heritage; Minaret of Bilal in Aswan: A Case Study

Esraa Elmallwany

Doctorate in Islamic Archeology and History, Tourist Guidance Department- Faculty of Tourism and Hotels- Minia University
Researcher in AI, Faculty of Artificial Intelligence- Kafr Elsheikh University

ABSTRACT

Technology has become an essential tool in restoration and digital reconstruction of endangered heritage sites. With the advent of Artificial Intelligence (AI), new methodologies have emerged that allow for the analysis, simulation, and preservation of cultural heritage in innovative ways. AI also plays a crucial role in democratizing access to cultural heritage. Virtual reality and augmented reality technologies, powered by AI, enable immersive experiences that bring historical sites and artifacts to life. This research explores the role of artificial intelligence and its applications in preserving heritage, especially the Islamic one. It also focuses on the historical building in Aswan called Bilal Minaret and the real name of the minaret whether it was al- Mašhad al-Qibli or al- Mašhad al-Bahari as endangered heritage. Moreover, the present research paper focuses on the minaret's location on the old village called al-Bab at eastern shore of the Aswan Dam Lake, south of the village of Al-Shallal, in front of Hisa Island. The paper aims to reconstruct the building via the recommendations of AI and revive the whole area according to these recommendations. The research indicates the dimensions of the building nowadays and its real shape in the past, as well as the imagination of the same building in the future after reconstruction via Al recommendations. The study depends on the descriptive approach; by making accurate description of the Minaret of Bilal, and it depends on the analytical approach, to analyze the current situation of archeological site, side by side with the experimental method in using modern techniques of artificial intelligence in the restoration of these areas.

KEYWORDS

Artificial Intelligence, Islamic Heritage, Minaret of Bilal, Al-Mašhad al-Qibli, Al-Mašhad al-Bahari.

توظيف الذكاء الاصطناعي في إحياء التراث الإسلامي؛ مئذنة بلال بأسوان
"دراسة حالة"

د. إسراء الملواني
دكتوراة في الإرشاد السياحي، كلية السياحة والفنادق، جامعة المنيا
باحثة في الذكاء الاصطناعي، كلية الذكاء الاصطناعي، جامعة كفر الشيخ

الملخص

أصبحت التكنولوجيا أداة أساسية في ترميم وإعادة بناء المواقع التراثية المهددة بالانقراض. ومع ظهور الذكاء الاصطناعي، ظهرت منهجيات جديدة تسمح بتحليل التراث الثقافي ومحاكات تفاصيله وحفظه بطرق مبتكرة. يلعب الذكاء الاصطناعي الان دورًا هاماً في الوصول السهل إلى التراث الثقافي وتطويره. كما تتيح تقنيات الواقع الافتراضي والواقع المعزز، المدعومة بالذكاء الاصطناعي، تجارب غامرة تجعل المواقع التاريخية والتحف الاثرية تنبض بالحياة. يركز هذا البحث على دور الذكاء الاصطناعي وتطبيقاته في الحفاظ على التراث، وخاصة التراث الإسلامي. كما يستكشف تفاصيل المبنى الاثري في أسوان المسمى مئذنة بلال. علاوة على ذلك، تركز الورقة البحثية الحالية على موقع المئذنة في القرية القديمة المسماة الباب على الشاطئ الشرقي لبحيرة سد أسوان، جنوب قرية الشلال، أمام جزيرة هيسا. كما يهدف البحث إلى إعادة بناء المبنى من خلال توصيات الذكاء الاصطناعي، وإحياء المنطقة بأكملها وفقًا لها. و يُوضح البحث الأبعاد الهندسية للمبنى حاليًا وشكله الحقيقي سابقًا، بالإضافة إلى تصور مستقبلي للمبنى بعد إعادة بنائه من خلال توصيات الذكاء الاصطناعي. اعتمدت الدراسة على المنهج الوصفي، من خلال وصف دقيق لمئذنة بلال، والمنهج التحليلي، لتحليل الوضع الراهن للموقع الأثري، جنبًا إلى جنب مع المنهج التجريبي باستخدام تقنيات الذكاء الاصطناعي الحديثة في ترميم هذه المناطق.

الكلمات الدالة

Introduction

Climate change and natural disasters, like volcanoes, earthquakes and wars pose challenge for surviving cultural heritage for many years; many cultural and touristic sites have been destroyed by these disasters[1]. The Artificial Intelligence has played a great role in preserving heritage. The relationship between heritage and AI isn't new, as for years there have been many attempts using various ways of digital technology to safeguard culture heritage[2].

Before shedding light on the role of AI in reviving Islamic heritage and reconstructing Bilal Minaret, the research focuses on what the AI is, its history and what the heritage is.

The term 'artificial intelligence' (AI) was used for the first time in 1955 by John McCarthy, a professor at Stanford University. He defined the term as "the science and engineering of making intelligent machines to behave in a clever way like humans, such as reasoning, learning, making decisions and natural languages processing". In fact, AI can perform many tasks far more quickly than people, including processing and examining vast datasets. Later, many scientists after McCarthy started to develop AI and use it in different domains[3].

Heritage is anything that has scientific, political, religious, cultural and historical importance for countries, communities or individuals. These things differ from one culture to another or from one region to another. Heritage has economic and aesthetic values as it traces history and connects between the past and the present. It is considered remembrances of the past achievements of individuals. There are different classifications of heritage: physical and nonphysical heritages, natural and cultural heritages and portable and unportable heritages[4].

1. Artificial Intelligence and Its Role in Reviving Heritage

Artificial intelligence (AI) plays a pivotal role in preserving, restoring and predicting the deterioration of historical structures and helping in their preservation via some techniques and tools as follows:

- **Restoration and Analysis:** With the advancements in sensing techniques and Structural Health Monitoring (SHM), various data patterns are being developed in the context of heritage preservation. Recent developments in deep learning for image processing have led to the exploration of damage detection techniques that utilize images and 3D point cloud data[5].

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[1] Pansoni, S., Tiribelli, S., Paolanti, M., Di Stefano, F., Frontoni, E., Malinverni, E. S., Giovanola, B. (2023). Artificial Intelligence and Culture Heritage: Design and Assessment of an Ethical Framework. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XLVIII, p. 1149.

[2] Todorović, M. (2024). AI and Heritage: A Discussion on Rethinking Heritage in a Digital World. *International Journal of Cultural and Social Studies*, Vol. 10, Issue 1, p. 3.

[3] El Hadi, M. M. (2023). Artificial Intelligence Background, Definitions, Challenges and Benefits. *CompuNet*, Vol. 31, p. 5.

[4] Omayio, E. O., Sreedevi, I., Panda, J. (2021). Introduction to Heritages and Heritage Management: A Preview. In *Digital Techniques for Heritage Presentation and Preservation*. Springer Nature Switzerland AG, pp. 3-4.

[5] Ali, A. A. A. (2023). *Thawrat al-Dhaka' al-Istina'i fi Majal al-Turath al-Thaqafi: Tatweer Taqniyat al-'Ard al-Mutahafi (The Artificial Intelligence Revolution and Cultural Heritage: Developing*

- **Optical sensing techniques:** These techniques have become a potent instrument for the non-invasive and non-destructive examination of cultural items. By revealing information on the composition, structure, and characteristics of different materials, optical techniques including holography, optical coherence tomography (OCT), electronic speckle pattern interferometry (ESPI), reflectography, and many other techniques which have made a revolution in the field of cultural heritage. Artificial intelligence (AI), particularly deep learning, has shown remarkable results in image-based damage detection. However, it can only identify surface-level, two-dimensional (2D) damages in heritage structures. Other sensing techniques, such as 3D point clouds, infrared sensing, ground-penetrating radar, and vibration response analysis, are integrated with AI algorithms to enhance damage detection capabilities[6].

- **Laser scanning:** It is one of the widely used techniques for cultural heritage preservation. Despite its advantages, it requires a huge amount of data and post-processing so that it takes a long time to create a manageable 3D model. Considering the goal of improving the metric description, current methodologies present an opportunity to develop new ways of representing and visualizing cultural sites. These methods enhance reconstruction and repair efforts and are effective instruments for site analysis. The laser three-dimensional scanning approach has the highest expectations in this field; it is a system that can function methodically in terms of acquisition speed and real-time data availability. In the event of rebuilding or a conservative project, it is imperative that the condition of a monument or site is documented and filed by using laser scan Focus3D by Faro[7].

- **Geographic Information System:** (GIS) has become an important tool for conservators, heritage managers, archeologists, and architects as it is necessary in creating complex and integrated information system[8]. It is defined as a technique that uses a series of overlapping images widely used for 3D modeling of cultural heritage, especially historical buildings. This independent method relies on triangulation from two or more images to digitally reconstruct the object's image. The integration of Geographic Information Systems (GIS) technology, including software, hardware, and procedures for managing spatial data, has proven to be extremely useful in capturing, editing, analyzing, and

Museum Display Techniques as a Model). Journal of the Faculty of Tourism and Hotels - University of Sadat City, Vol. 7, Issue 2, p. 48.

[6] Ambrosini, D., Ciccozzi, A., De Rubeis, T., Paolletti, D. (2023). Optical Methods: Imaging the Hidden World of Cultural Heritage. *4th International and Interdisciplinary Conference on Images and Imagination*, L'Aquila (Italy), pp. 314-316.

[7] Vacca, G., Deidda, M., Dessi, A., Marras, M. (2012). Lasser Scanner Survey to Cultural Heritage Conservation and Restoration. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. XXXIX-B5, pp. 589-590.

[8] Petrescu, F. (2007). The Use of GIS Technology in Cultural Heritage. *XXI International CIPA Symposium*, 01-06 October, Athens, Greece, p. 1.

representing spatial data for archaeological sites and historical structures[9]. GIS allows for a more comprehensive approach to heritage preservation and facilitates the development of virtual historical collections and archives, recognizing the integration of heritage sites with their surrounding landscapes[10].

- **Chatbots:** also known as "talkbots," "chatterbots," or simply "bots,". They have evolved significantly in the computer age as computer programs capable of simulating conversation using auditory or textual methods. More specifically, the functions of chatbots rely on Natural Language Processing (NLP). It could help in providing information to the visitors about the history of the site, the architecture design, when they can visit, and when they have to leave[11]. Neural linguistic programming (NLP) can be defined as the ability of machines to analyze, understand, and generate human speech. By simulating human speech, chatbots bridge the gap between human communication and computer understanding. Chatbots are now supported by Deep Learning, which accelerates the methods by which chatbots can learn to understand user intent and context to predict and provide more personalized content and information. Also, they can be used in providing recommendations for restoring archeological sites[12].

2. Historical Background

The Beja or Nubian people criticized the peace treaty with Muslims during the Abbasid era, particularly under the rule of Caliph al-Mutawakkil (847-861 AD), since they attacked Arab miners and refused to pay Jazya. Ali Baba led the Beja army in the fight, and the Caliph gave the order for his army, led by Muhammad Abd-Allah al-Qammi, to destroy them[13]. According to historians, Yurki "Georgios," the Nubian monarch, and Ali Baba were taken as captives and taken to Baghdad to meet Caliph al-Mutawkil[14]. In 956 AD, Ikhshidid carried out another campaign against the Nubians, during which he killed many of them and took 150 captives[15].

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[9] Ali, E. (2020). Geographic Information System (GIS): Definition, Development, Applications & Components. Department of Geography, Ananda Chandra College, p. 1.

[10] Bushmakina, Y. V., Balyberdina, P. A., Dmitrieva, M. K., Gogoleva, M. V. (2017). The Use of GIS for Studying Cultural Heritage and Historical Urban Landscape: The Case of Perm and Usolie (Russia). *Ge-conservación*, No. 11, p. 266.

[11] Caramiaux, B. (2023). AI with Museums and Cultural Heritage. In S. Thiel & J. C. Bernhardt (eds.), *AI in Museums: Reflections, Perspectives and Applications*. Bielefeld: transcript Verlag, p. 123.

[12] Tosey, P., Mathison, J. (2010). Neuro-Linguistic Programming as an Innovation in Education and Teaching. *Innovation in Education and Teaching International*, Vol. 47, No. 3, p. 2.

[13] Sudan Archaeological Research Society. (2000). Sudan and Nubia. *Bulletin*, No. 4, p. 38.

[14] Harbek, (ed.). (1992). UNESCO General History of Africa, Vol. III, Abridged Edition: *Africa from the Seventh to the Eleventh Century*. James Currey, California, p. 106.

[15] Bruning, J. (2020). Slave Trade Dynamics in Abbasid Egypt: The Papyrological Evidence. *Journal of the Economic and Social History of the Orient*, p. 687.

There were numerous uprisings during the Fatimid[16] Caliph al-Mutansir's[17] reign (1035–1095 AD), particularly in southern Egypt. He sent his own Syrian army to the south and began to crush the rebellions after calling on his vizier, Badr al-Jamali, to do so[18]. Then, he built several defensive sites there, such as the Bilal Minarets, and formed a new system that was effective in civic, political, and judicial activity. However, another viewpoint contends that these minarets were built during the time of the Abbasid caliph al-Moutawakel[19].

3. Location

The Aswan Nile flows through a valley that includes rocky hills covered with granite blocks. At the foot of these hills there are a number of Nubian villages that were built during the second raising of the High Dam, as water completely submerged them. The site is located south of al-Shillal village after Philae Island[20] and in front of Hisa Island[21] as there were two villages on the eastern bank, the first and the northern one was called Al-Mašhad al-Bahri or Al-Bab, and the second is called Al-Mašhad al-Qibli or Bilal[22]. According to Creswell, many archeologists have argued about naming the minaret of Bilal as al- Mašhad al-Qibli or al-Bahri, and in this research, it will be referred to as al- Mašhad al-Bahri.

4. The Foundation of Bilal Minaret

The inscription on Mašhad al-Juyushi in 478 AH/1085 AD is one example of a Fatimid monument that used the term of Mašhad. In addition to having areas for prayer, this structure was used to observe seasonal and holiday celebrations. This does not imply that they have the right to be regarded as a mosque.

Since there were no inscriptions attributed to any of the Prophet's family members, archaeologists disagreed over the purpose of this Mašhad. Additionally, it differs from

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[16] Fatimids: Was one of Ismaʿill Shiiʿ Islamic sects, they conquered North of Africa during the 10th century. They tried to conquer Egypt many times until they succussed during the reign of their fourth caliph al- Muʿizz. See,
Baker, C. D. (2019). *Medieval Islamic Sectarianism*. Arc Humanities Press, p. 80.
[17] His name was Abou Tamim al- Mustasir bi Allah, he was the eighth caliph of the Fatimid dynasty in Egypt. He was born in 427-487 AH/ 1035-1095 AD, ruled after his father caliph az- Zahir. His mother was a slave from Sudan. See,
O'Leary, D. D. (1923). *A Short History of the Fatimid Khalifate*. John Robert Press Limited, London, p. 193.
[18] Montasser, D. M. H. (2000). Monumental Quranic Inscriptions on Cairene Religious Monuments. (Master's Thesis). *The American University*, Egypt, p. 27.
[19] Shafʿy, F. (1994). *al-ʿImārah al-ʿArabiyyah fī Miṣr al-Islāmiyyah: ʿAṣr al-Wulāt [Arab Architecture in Islamic Egypt: The Era of the Governors]*. Egyptian General Book Authority, p. 578.
[20] UNESCO Campaign moved Philae Island from its original location in 1960 to the area around Agilkia Island. The most well-known building from the Ptolemaic era is the temple of Isis, which was constructed by Ptolemy II Philadelphus. See,
Ministry of Tourism and Antiquities. (n.d.). Philae. *Discover Egypt's Monuments*. Retrieved December 14, 2021, from https://egymonuments.gov.eg/en/archaeological-sites/philae
[21] One of the Nubian islands which gets its name from the name of the pharaoh king Hesse. See,
Study in Egypt. (n.d.). Hisa Island. *Study in Egypt*. Retrieved December 14, 2021, from https://study-in-egypt.gov.eg/listing/166/Hisa%20Island
[22] Creswell, K. A. C. (2004). *al-ʿImārah al-Islāmiyyah fī Miṣr [Islamic Architecture in Egypt]*. (Translated by Abd al-Wahhab ʿUlūb, Vol. 1). Zahraa al-Sharq Library, Dar Aal-Qahira, p. 158.

the ones that were constructed in Moqattam, where the construction was connected to the cemetery or Qarafa that observed the festivities. And they came to the conclusion that it is primarily one of Badr al-Din al-Jamali's battle scenes, which he set up to keep an eye on the southern boundaries, particularly the western land road going to Nubia and the river road. This area's minaret served two purposes: it was used to broadcast the call to prayer and to keep an eye out for and alert people to any danger[23].

5. The Architecture Design

There is a great change between Bilal Minaret's old site and the current one.

5.1 The Original Site

The minaret is composed of three sections a square base that is approximately 4.15 m long and 4.58 m high, with granite blocks used to construct the bottom portion. A cylindrical body that is 4.43 meters high and has three small openings to light the steps, and it is located above this base. The final component is a 2.5-meter-square kiosk or jawsq that was constructed of bricks and has arched windows on either side of the cylindrical body. Above all, there is a dome with star holes all over it (plate 1)[24]. According to Muhammed Othman, the Minaret's base measures roughly 4.10 meters on each side, and its cylindrical body has a diameter of roughly 4.10 meters at the base and 3.25 meters at the top[25].

Plate 1: Old Photo of al- Mašhad al-Bahari and the mosque with domes which is now completely destroyed. After: Archive of Antiquities of Upper Egypt's region.

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[23] Shafʿy, *Al-ʿImārah,* p. 578.
[24] Creswell, *al-ʿImārah,* p. 158.
[25] Othman, M. A. E. (2006). ʿImārat al-Mashāhid wa-al-Qibāb fī al-ʿAṣr al-Fāṭimī [Architecture of Mausoleums and Domes in the Fatimid Era]. Dar al-Qahira, p. 171.

Plate 2: Photo of the old site after editing on AI application.
After: https://www.arabygpt.araby.ai/media-tools/image-tools/color-image, Last access 12ᵗʰ January 2025, 10:32 PM

5.2 Current Construction

The registration decision for Al-Mašhad al-Bahari was documented in Ministerial Order No. 10357 for 1951 AD. Reports from the Authority of Antiquities of Upper Egypt indicate that al-Mašhad al-Bahari's current proportions have somewhat changed. The following can be observed when examining the present location and the construction of Bilal's minaret:

- The construction's dimensions have changed, decreasing by roughly 5 cm.
- The minaret has undergone numerous restorations, but these were not good because they did not take into account matching the original. For example, when rebuilding the wall facing the Nile, it was originally a semicircular arch, but after restoration it became rectangular.
- The square base was filled with cement concrete without considering the need to leave an internal hollow, it has undergone inadequate restoration.
- The two remaining minarets are completely collapsed.
- Bricks covering the square minaret's base are falling.
- On the southern side of the square base, there is a semicircular arch that resembles a locked door.
- A 60 cm long by 50 cm wide square section sits above this arch; perhaps there was a foundation text there.
- There are obvious signs of wetness on the minaret's cylindrical body.
- The southwest portion of the minaret has a modest inclination. The wall that encircles the minaret collapsed.

Plate 3: Current construction of Minaret of Bilal. After: Abd Allah Salah, *Mʾḏnt Bīlāl Āqdm āl-Āṯār āl-īslāmyā Bǧnūb Mīsr*, Youm 7, 28 May 2024, https://www.youm7.com/story/2024/5/28/, last access 1ˢᵗ of January 2025, 10:00 PM.

The Inscriptions

Some inscriptions are inscribed in Kufic script, which uses bricks and may be written either vertically or horizontally depending on the situation. These inscriptions are located around a meter below the Jawsaq[26]. The presence of this Kufic lettering on the cylindrical body of the minaret led some archaeologists to date its construction to the Abbasid period (plates 4, 5). This type of inscription was discovered in the right section of the Abbasid Caliph "Al-Mutasim's" palace in Al-Rafa.

Hassan Al-Hawari interpreted this writing as follows:

"In the name of God, and by God, this minaret was raised by Ubaid Muhammad Ibn Uhud Ibn Salamah, seeking the reward, mercy and approval of God." "The work of Hatim al-Banna and his son."

"بسم الله وبالله رفع الله هذه المنارة عبيد محمد بن أحمد بن سلمة طلباً لثواب الله ورحمته ورضوانه" "عمل حاتم البنا وولده"[27].

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[26] Creswell, *Islamic,* p. 159
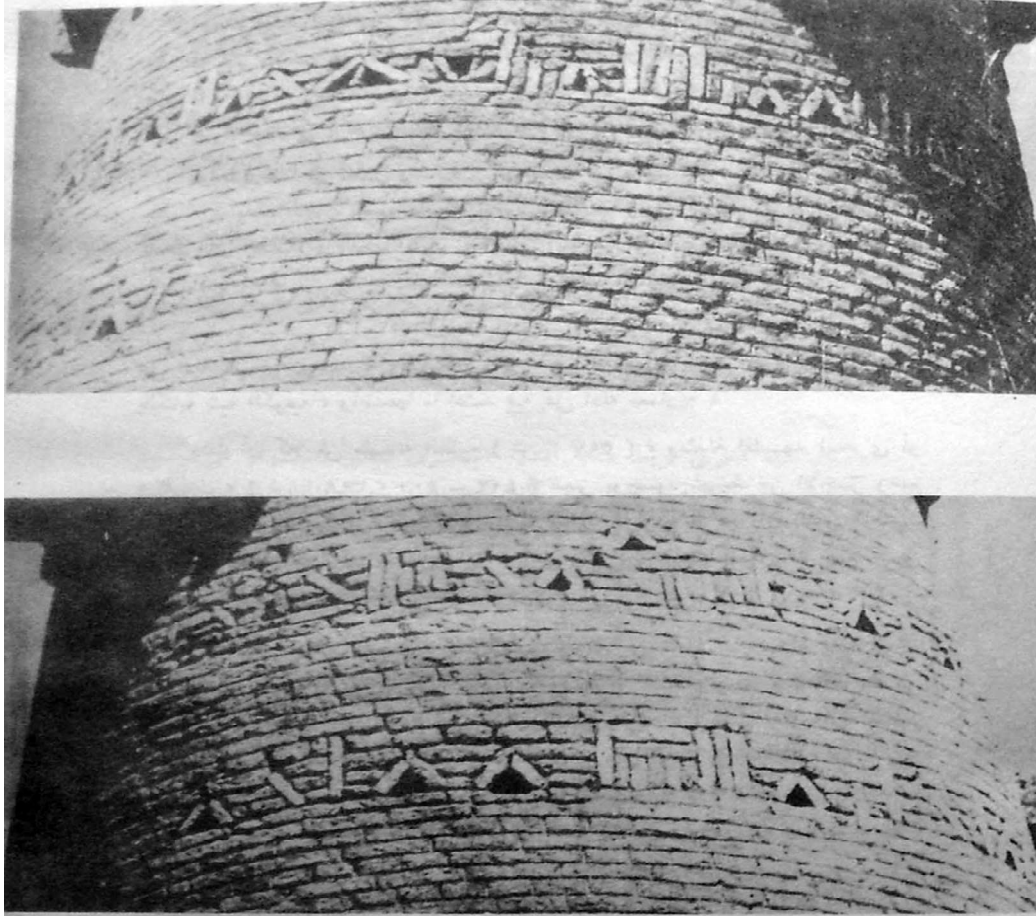[27] Shafʿy, *Al-ʿImārah,* p. 578

Plate 4: The Kufic inscriptions which are written on the Bilal minaret. After: Shafʿy, *Al-ʿImārah,* p. 577.

Plate 5: Inscriptions on the cylindrical body with Kufic script. Taken by Hassan Jabr the manager of the Antiquities Authority of Upper Egypt.

6. How to Reconstruct Bilal Minaret with AI

After introducing all information to DALL·E3 and ChatGPT applications of AI about both original and current constructions, research will display each problem and how to solve and reconstruct the building as follows[28]:

6.1 Current Problems and Proposed Solutions

1. **Issue:** Dimensions have decreased by 5 cm as a consequence of normal use.
   Solution: Restore the worn components with brick and granite that are comparable to the original materials. To stop future wear, use surface protection methods like transparent insulating paint.

2. **Issue:** Cement concrete is used to construct the square base.
   Solution: To prevent causing structural damage, carefully remove the concrete from earlier restorations. Natural lime mortar that matches the original materials organically should be used to refill the base that will help the minaret to breathe.

3. **Issue:** Bricks falling from the base.
   Solution: To fix the damaged areas, use bricks that are the same size and color as the original material. Use mortar that is suitable with the original bricks to reinforce the base.

4. **Issue:** Moisture symptoms on the cylindrical body.
   Solution: Inject waterproofing materials (also known as injection grouting) into the impacted areas to treat the moisture. To decrease the impact on the environment, improve the water drainage around the minaret.

5. **Issue:** The southwest part has a slight slant.
   Solution: While examining the foundation, stabilize the minaret with makeshift supports. Using contemporary technical methods, such as progressively raising the base or strengthening the impacted side, correct the tilt.

6. **Issue:** The arch that faces the Nile is now rectangular in shape instead of semi-circular.
   Solution: Using old records and photographs as a guide, restore the arch to its semi-circular form. To guarantee that the minaret's historic shape is preserved, use materials that closely resemble the original.

7. **Issue:** The two other minarets completely collapsed.
   Solution: Restore the lost minarets while maintaining the original building style, using historical records and photographs if available. Utilize contemporary methods to guarantee the new structure's solidity and conform to the overall aesthetic.

8. **Issue:** The adjacent wall collapsed.
   Solution: To safeguard the minaret, construct a new wall with a design akin to the original. Post educational boards close to the wall to inform guests of the significance of the minaret.

9. **Issue:** High groundwater levels and moisture.
   Solution: To reduce the effect of groundwater, install a drainage system around

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[28] OpenAI. (n.d.). *DALL·E 3*. Retrieved January 12, 2025, from https://openai.com/index/dall-e-3/; OpenAI. (n.d.). *ChatGPT conversation*. Retrieved January 12, 2025, from https://chatgpt.com/c/6784066b-d300-8005-8910-8904faea363b.

the minaret. To guard against future wetness, use waterproofing elements in the foundations.

10. **Issue:** Lacking overall security.

Solution: To monitor structural changes, install sensors and a monitoring system (cameras). Increase local community awareness and include them in site protection.

6.2 Future Preventive Measures

- **Environmental Surveillance:** Set up environmental monitoring devices to keep tabs on variations in the site's temperature, humidity, air quality, and pollution levels. This will facilitate the early detection of such hazards and allow for the implementation of suitable preventive measures.

- **Monitoring Structural Health:** To regularly evaluate the structure's integrity, use cutting-edge structural health monitoring technology, including fiber optic sensors, strain gauges, and acoustic emission sensors. This would offer up-to-date information on any possible strains or vulnerabilities.

- **Protection from Seismic Activity:** Use seismic retrofitting methods to protect from possible earthquake damage to the minaret. This may entail employing contemporary dampening devices to absorb earthquake energy or adding reinforced components to the foundation.

- **System to Prevent Fires:** Install fire detection and suppression systems throughout the property, paying particular attention to high-risk fire regions. To protect the minaret, these could incorporate automatic fire suppression systems, smoke detectors, and fire extinguishers.

- **Engagement and Public Education:** Provide educational events and workshops emphasizing the minaret's historical significance and the value of its preservation for both the local population and tourists. Involving the public in these initiatives promotes a feeling of site ownership and responsibility.

- **Combining Smart Technologies:** Use smart technologies, like a website or a mobile app, to allow users to track the condition of the minaret, report any issues, and access comprehensive information about the restoration process. This will increase public awareness and participation.

- **Sustainability in Restoration:** Make sustainable practices—such as utilizing eco-friendly materials, cutting back on energy use, and limiting waste—a priority in all upcoming restoration projects. By doing this, the structure's longevity will increase without endangering the environment.

- **Cooperation with Institutions of Cultural Heritage:** To guarantee that the minaret's preservation adheres to worldwide best practices, form solid alliances with national and international cultural heritage groups. These collaborations may also provide capital and experience for next initiatives.

- **Plan for Emergency Response:** Create and update an emergency response plan that specifies what to do in the event of a fire, natural disaster, or structural failure. To guarantee quick action in emergency situations, this strategy should be distributed to the public, restoration teams, and local authorities.

- **Utilizing 3D Scanning:** Utilize digital modeling and 3D scanning tools to produce a digital archive of the minaret. This will prevent further strain on the

physical structure and enable in-depth research, future restoration references, and even instructional virtual tours.

7. Imagination of AI for Bilal Minaret

Artificial Intelligence and its applications made some imaginations for Bial Minaret and the whole Nubian area after reconstruction, AI added some cafes and Nubian bazars around the minaret as follows[29]:

Plate 6: A photo done by AI for the area of Bilal Minaret after adding some cafes, landscape and lights in the area.

[29] MyArchitectAI. (n.d.). *Architecture Generator*. Retrieved January 13, 2025, from https://www.myarchitectai.com/architecture-generator;

MNML AI. (n.d.). *Style Transfer*. Retrieved January 13, 2025, from https://mnml.ai/app/style-transfer;

Haiper AI. (n.d.). *Creations*. Retrieved January 13, 2025, from https://haiper.ai/creations;

ArabyGPT. (n.d.). *Color Image Tools*. Retrieved January 12, 2025, from https://www.arabygpt.araby.ai/media-tools/image-tools/color-image.

Plate 7: AI imagine the original building of Billal Minaret before destruction.

Plate 8: Imagination done by AI for the whole area after construction of Nubia bazars, cafes, landscape and lights.
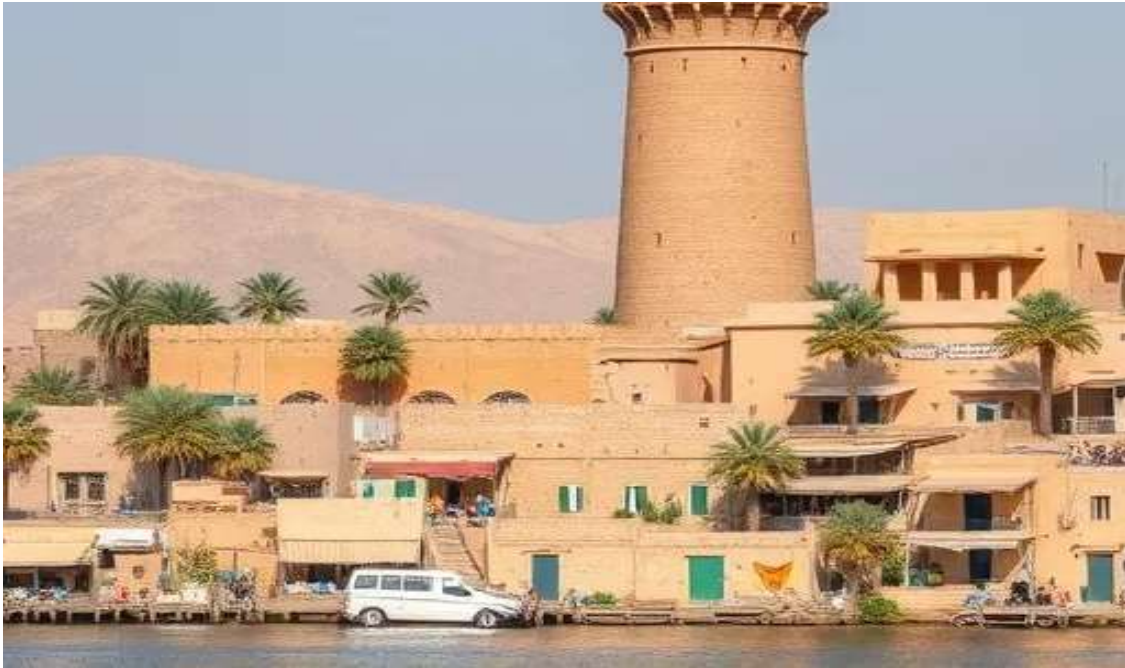
Plate 9: The minaret of Bilal and Nubian Houses in front of it, the imagination done by AI.

Conclusion

The Artificial Intelligence (AI) has made a great revolution in reviving Islamic heritage. AI also could make a reconstruction of the Minaret of Billal in Aswan. AI and its applications could make imagination for the whole area after reconstruction and help in providing practical solutions or recommendations that can be applied in the field of Islamic heritage and Islamic antiquities in Egypt. It also plays a pivotal role in predicting the deterioration of historical structures and helping in their preservation.

Artificial Intelligent introduce some advices for the reconstruction of the Minaret by using some technologies like: Restoration and Analysis, Optical sensing techniques, Laser scanning, Geographic Information System (GIS) and Chatbots.

Artificial Intelligent recommended for preserving the Minaret in the future by making Environmental Surveillance, Monitoring Structural Health and Protection from Seismic Activity. It also advised to use system to prevent fires, engagement and public education, combining smart technologies, sustainability in restoration, a plan for emergency response and utilizing 3D scanning as well as cooperation with institutions of cultural heritage.

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