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THE VIRTUAL DOCUMENTATION ROLE IN REFORMULATING THE HERITAGE OF BASRA CITY

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Abstract

Introduction: Virtual reality documentation technology can help urban designers and architects reformulate heritage buildings, especially in Basra City. **The purpose of the study** was to introduce VR technology's technological potential, as it allows the reviving of these buildings. **The following methods were used:** desktop analysis to analyse relevant studies regarding virtual reality documentation and its technologies. The study selected Basra Old Court as a case study. It also conducted two questionnaires that were distributed online, including a link to a virtual heritage platform (VHP). The first questionnaire was directed to a random sample of 20 architects and urban designers to determine the appropriate conservation policy for the case study, depending on their professional opinions. The other questionnaire was directed to (157) residents to justify the results. Moreover, the AutoCAD and Revit programs were used as digital documentation tools to document the case study, producing two VR models that represent two conservation policies (traditional and developmental policy). **The data analysis** showed that experts and residents preferred the VR model I of the heritage building to preserve its original form without additions. **In conclusion**, this approach can examine the selected conservation strategy for the heritage building before the implementation stage.

Keywords: virtual reality documentation (VRd); heritage buildings; virtual heritage; realistic simulation; developmental simulation.

Introduction

Virtual reality documentation (VRd) technology can help urban designers and architects reformulate heritage buildings. This study reviews the documentation in relevant studies to identify methods of documenting heritage buildings using VR technology. Ahmed (2017) highlighted three levels of relationship between heritage and technology. The partial level involves using digital formative models to draw inspiration and incorporate key elements from traditional formative vocabulary. The implicit level involves abstracting, processing traditional, and heritage vocabulary by integrating it with environmental factors. The controlling level uses mathematical equations and digital tools called integration and generation processes between heritage thought and environmental design. The last one is the most abstract level, combining two or more heritage values like form, function, and environmental considerations to create a unique design (Ahmed et al., 2017).

The importance of VRd and its role in controlling the actual space virtually directly through the applications of data, information, and communication technology was studied as one of the vital areas for monitoring and preserving buildings with accurate heritage dimensions (Mahrouq and Al-Haddad, 2001).

Jaillot (2020) examined the digital urban heritage tool that contributes to introducing urban cultural heritage to the community with digital techniques. This includes accessible applications or websites that enhance understanding and increase awareness about the city's development. The participatory property of exchanging knowledge invites professionals and non-professionals to view the urban cultural heritage and participate in creating new knowledge (Jaillot et al, 2020).

On the other hand, smart heritage was introduced to design, rehabilitate, build, manage, and maintain architectural heritage operations to become more straightforward and explicit (López et al., 2018). This concept facilitates designers' giving alternatives for the operations' development through heritage modelling, digitally representing the built environment characteristics (physical, functional, semantic, structure, or existing building) using 3D applications: Revit Autodesk, Tekla Structures, and Bentley Systems.

In terms of documenting methods, El-Din's (2021) study proposed two methods for documenting heritage buildings. The traditional method relies on individual abilities and traditional measurement tools, including written description, drawing, recording, and photography. The modern method

has adopted various heritage modelling techniques, such as photogrammetry and the 3D laser scanner, which is unsuitable for documenting demolished archaeological buildings. El-Din also viewed the BIM technique to document the Seven Domes Building (Seven Girls) in Cairo, with a three-dimensional redesign using the Rivet program to rebuild and complete the monument using bricks as a traditional basic material corresponding to the monument's value (Fig. 1) (El-Din, 2021).

Similarly, Markarian (2018) showed two techniques for photographic architectural documentation in the Ashar River in Basra City: the direct and indirect methods. The direct method includes studying the building in its current form and creating various data based on photographs, while the indirect method collects information and documents from various formal and informal sources. The revival of the destroyed buildings aims to document the state of buildings or the destroyed buildings through various documents, the most important of which are photographs.

Younus et al. (2023) explored the role of VRd in reconstructing the building Khan Hamu Al-qudu in Mosul City, which was destroyed by wars, using the information modelling technique (HBIM). This technique has been considered a strategy for the sustainability of heritage and its survival and continuity within the collective consciousness by connecting digital technology with heritage buildings as a collective product, expressing the city's memory and the connection between the past and the present. The technique used the Revit 2021 program as a BIM program to generate a 3D model. The program was adopted to design doors, windows, and the inner courtyard, with multiple possibilities to reconstruct them digitally and in their original forms (Fig. 2).

Markus (2023) recently investigated the perception of heritage elements in three dimensions using digital programming. This method allows designers to create creative forms using the options provided by digital programming. The study highlighted the importance of geometric accuracy, adjustments in the design process, resolution levels required to digitize objects and surfaces, distance measurements, and the way the triangular element can be held inside the computer environment (Markus, 2023).

Objectives:

The research aims to achieve the following:

1. To examine the role of VR technology in documenting neglected heritage buildings in Basrah City and to assist experts in determining a suitable conservation policy for them.
2. To enhance the community's participation in decision-making, recognize their role as key stakeholders, and ensure that the chosen policy meets their sense of belonging.

Literature Review about VRd and potential indicators

Virtual Documentation (VRd)

It is the documentation, registration, and rooting of heritage buildings' architectural, historical, and geographical values to preserve them within the spatial and community memory. It also facilitates rehabilitation, development restoration, and future maintenance of the heritage site (Ali and Markarian, 2014). According to Abdulrahman and Ahmed (2006) and Ali and Markarian (2014), VRd embodied in three main points. Firstly, dynamic storage and

Fig. 1. The documentation of the Seven Girls Building El-Din's (2021)

Fig. 2. Khan Hammu Al-qudu (Younus et al., 2023)

retrieval, where the available programs enable the establishment of essential relationships between the components of heritage items in multiple images that cannot be displayed traditionally. Secondly, dynamic display and visibility where models of sites, buildings, and elements of urban heritage can be saved on an accurate scale and displayed in multiple virtual environments that reflect the extent of harmony and compatibility between them. Thereby, it achieves higher degrees of understanding, analysis, and study. Thirdly, dynamic control and processing, documentation is essential for creating comprehensive databases by preparing a modular reference system. It also supports collecting and classifying the city's heritage buildings through images and writings and storing them with similar types for easy viewing and evaluating reality.

General directions of documentation:

The documentation depends on the heritage building's values, which are generated through the building's form and function, as which of them bears the change in exchange for the stability of the other party, or both (Fig. 3), which are as follows:

The reconfiguration direction:

- *Reuse (non-change direction)*. It means modifying, converting, or changing the heritage buildings' uses that have lost their original function by being in a good structural condition to other uses that suit current needs and ensure the protection of the building. Reuse can be optional for buildings whose original function still exists today. It can also be compulsory for buildings whose original function has become extinct, such as ancient temples and cemeteries, to prevent them from becoming abandoned. This is related to the possibility of the building adapting and merging with the city's urban fabric (Serageldin, 1999).

- *Shape reconfiguration (relative change direction)*. This direction concerns old buildings that are less significant architecturally and historically. This is to meet the building's new use requirements, which may mean removing or excluding facilities added after its construction. Integrating the new use with the building requires care because historical buildings have shapes subject to the construction conditions or the designer's thoughts, in addition to several factors influencing how to deal with the building to achieve its purpose functionally and aesthetically (Ismaeel and Torre, 2010).

- *The reconstruction direction (complete change)*. A new reconstruction of a destroyed site or building, restoring it entirely or with parts and features that do not exist to copy its appearance and shape characteristic of a specific time. This process takes place in two cases: preserving and improving the aesthetic value and presenting it understandably or consolidating and strengthening the monument to preserve it (Al-Obeidi and Sharif, 2019).

Considerations of VRd

The virtual models support the process of imagination and visualization required to realize the importance of the heritage element and its dimensions with the necessity to consider the following concepts (Abdulrahman and Ahmed, 2006).

- *Credibility*. When preparing the heritage element, the proportions in the three dimensions must be achieved correctly. Without documented information about the heritage item, a block model is sufficient without details that may adversely affect its heritage value.
- *Flexibility.* It is related to the preparation, treatment, and display methods. These methods show different stages of the heritage element, including origin, deterioration and transformation, and current status, as each stage can be displayed separately**.**
- *Details level.* It is one of the essential factors that affect the preparation and processing of digital forms, the proposed presentation style, the way to show it in terms of the processing type approved, and how it relates to the original element's identity within the digital heritage form.
- *The heritage element's perceived value.* It is essential to emphasize the value of the heritage element through its presentation style and level of definition. The digital model highlights the quality of non-existing urbanization in a manner consistent with the available and documented information**.**
- *Complementary elements of the resulting model.* The importance of the 3D form is represented by the elements used to express the urbanism language, such as lighting, color, texture, space, function, and content in which the heritage element is located.

To conclude, the main indicators and possible measurement values were identified to be applied

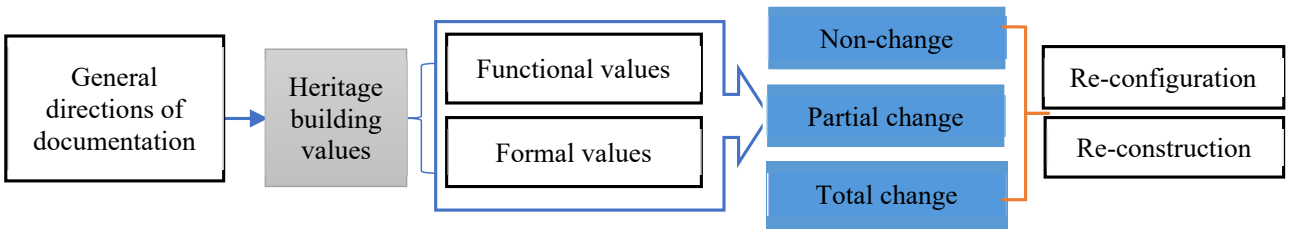


Fig. 3: The general directions of documentation (done by researchers)

to the case study and to measure the role of VRd in reformulating heritage according to the theoretical proposition (Table 1). To facilitate dealing with the main variables, they were coded from A1 to A13. The sub-variables adopted the encoding of their main variable, such as A1; its secondary variables are A11 and A12.

The VR Technology for Heritage Documentation

The importance of VR in reviving and preserving architectural heritage is based on adopting new techniques in a three-dimensional virtual environment by adding audio technology as an essential step for preservation and documentation, increasing awareness about local heritage. These techniques are essential steps in the documentation, conservation, and dissemination of heritage (Alqalami, 2020), in addition to assisting in decision-making in various restoration projects (Jaleel, 2018). The heritage buildings' documentation is essential to preserve, protect, and sustain them. Therefore, it is necessary to understand the building's data, history, and information to establish the conservation process based on a comprehensive knowledge of the building's condition that determines a plan and method of dealing with it without damaging its value (El-Din, 2021). The heritage virtual model also has educational and historical values used to evaluate the building's development by comparing 3D at different times, so it becomes easy to compare the present and the past, evaluate and measure the changes caused by time (Fassi et al., 2016).

Table 1. **Indicators Extracted from theoretical Framework**

Main Indicators	Variables	Symbols	Sub-variables		Symbols
General trends for dealing with heritage buildings virtually	Reconfigure the use	A1	Optional restoration of the building's functionality: its original function still exists.		A11
			Compulsory restoration of the building's functionality: its original function disappeared.		A12
	Reconfigure the shape	A2	Adding a new formation to the heritage building.		A21
			Adding detailed elements to traditional facades.		A22
	Reconstruction direction	A3	Preserving and improving the building's aesthetic value.		A31
			Strengthening and enhancing the building structurally as a conservation measure.		A32
VRd possibilities	Structural evaluation of the heritage building	A4	The building's structure is deteriorated, and its heritage image is incomplete.		A41
			Changing the heritage building's condition (formalism and functionalism).		A42
VRd considerations	Creditability	A5	The VR models maintain the building's correct proportions.		A51
			The significance of the VR is to reflect the building's function and heritage.		A52
	Flexibility	A6	The building's ability to accept change.	At the form level	A61
				At the function level	A62
	level of detail	A7	The compatibility of the added elements with the building's traditional image.		A71
	The perceived value of the heritage item	A8	The VR models clarify the heritage value.		A81
			In VR models, the building combines heritage and modernized values.		A82
	Complementary elements of the resulting model	A9	The heritage elements are a vivid image of the building's reality.		A91
			The added contemporary elements gave the building a new image.		A92
Representation of the heritage building's historical significance in VR	Construction time and its historical age	A10	The building's virtual image preserves its historical dimensions.		A101
	Its architectural and aesthetic value	A11	The building's aesthetic value is in its traditional form.		A111
			The building's aesthetic value is in its contemporary form.		A112
	The event	A12	Changing the reading of the building as it has heritage events reflected in its proposed images.	At the site level and its relationship to the place.	A121
				At the level of added detailed treatments.	A122
Virtual heritage documentation techniques	Simulation	A13	Realistic simulation.	Accepting the virtual image that matched reality.	A131
			Developmental simulation.	Accepting the developed virtual image.	A132

Virtual heritage is the simulation and documentation of the characteristics of heritage sites within a virtual environment using information and communication technologies (Chehab and Nakhal, 2023). This technology provides an immersive VR experience with self-guided interactive visualization produced by computer systems and presented in a three-dimensional artificial form (Eljojo, 2019). It also represents digital resources transformed from the existing natural and cultural heritage, including dynamic or static digital processes created during digitization, such as creation, documentation, preservation, protection, processing, and dissemination (Wang et al., 2020). Its characteristics consist of buildings' reenactment using horizontal standard plans, sections, facades, and physical objects with computer models and animated films to form 3D models to revive heritage buildings that are difficult to rebuild. Partially dilapidated buildings can also be completed; therefore, these models give insight into how the building is partially treated (Fig. 4) (Osman, 2017).

Simulation in design is defined as the construction of geometric digital models using several methods, including traditional simulation using two-dimensional graphics, three-dimensional simulation using photography, and scanning simulation by photogrammetry or laser techniques (Baky, 2020). The simulation is achieved by creating an imaginary model that simulates all the conditions and factors affecting it through a complex 3D image environment, using simulators, which allow one to walk around inside the virtual environment (Jaleel, 2018). The current study classified the simulation into realistic simulation, which creates identical models of reality, and developmental simulation, which builds possibilities that are not identical or imitated but are treated with images showing the inherent potential of the building (Hassan, 2009).

Virtual heritage platforms (VHP) are one of the VR technologies. They are research and educational tools that redefine heritage buildings for users through simulation and physical modeling of archaeological sites or data. They have an impact on the people's cultural nutrition by helping them understand the socio-cultural context (Abdelmonem, 2018).

The current study employed a VHP as a documentation tool to meet the research aims. It is easily accessible, as one only needs a smartphone and Internet. It was adopted to collect and present data to the target audience in an interactive and meaningful way. Two platforms were created, the first designed for experts and the other for Basra residents.

The Case study:

Basra Old Court building is one of the distinguished heritage buildings in the ancient city fabric. In 2023, UNESCO conducted several studies to revive the architectural heritage of ancient buildings in Basra, including this building (Hameed, 2014) (Fig. 5).

The most important criteria for accrediting this heritage building are:

- *Historical Value:*

It includes three standard values (Dairy and Mohammed, 2018). Firstly, *the* ***event (regional, national, and local)****:* The building is linked to the local events of Basra's old fabric, distinguished by the water canals' presence. It is considered the oldest building for justice and governance after the 1920s, the independence of Iraq, and the beginning of national ownership. Secondly, ***the building's age:*** The old court was established during the period (1935–1938) with the construction of Al-Maqal Port Airport, the main commercial area in the Al-Ashar Center, the central residential area, and the administrative buildings in the old centre of Basra, (Ocal, 2016). Thirdly, ***location***: The court building is distinguished by its location among the distinctive heritage elements of Basra's ancient fabric, such as the Ashar River and the Shanashil houses (Rajab et al., 2022).

- *Architectural value:*

It is achieved by, firstly, ***Style*****:** The building was designed in the English style that prevailed in Basra (1930-1950) regarding the repetition of windows and building materials (Kalman, 1980). ***Secondly, Function***: It first appeared as a house of justice under the Basra Court of Appeal and the centre of public administration in the city, which operated from 1938 to 1980. Thirdly, ***structural value*****:** It is displayed in the old English colonial style, as shown in (Fig. 6). ***Fourth, aesthetic value*****:** The building is an architectural icon of the city. Still, it was neglected

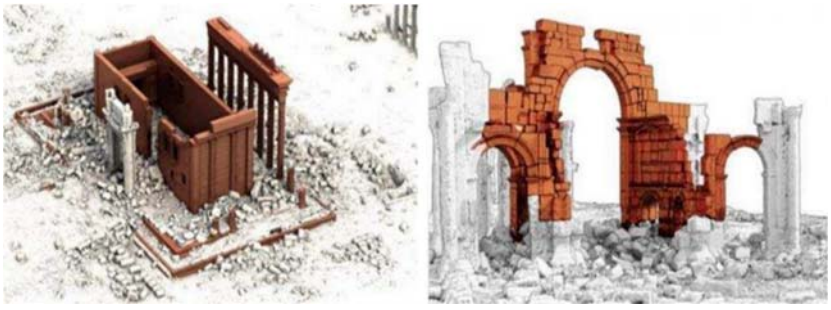


Fig. 4. Completion of the 3D documentation of Palmyra in Syria City (Osman, 2017)

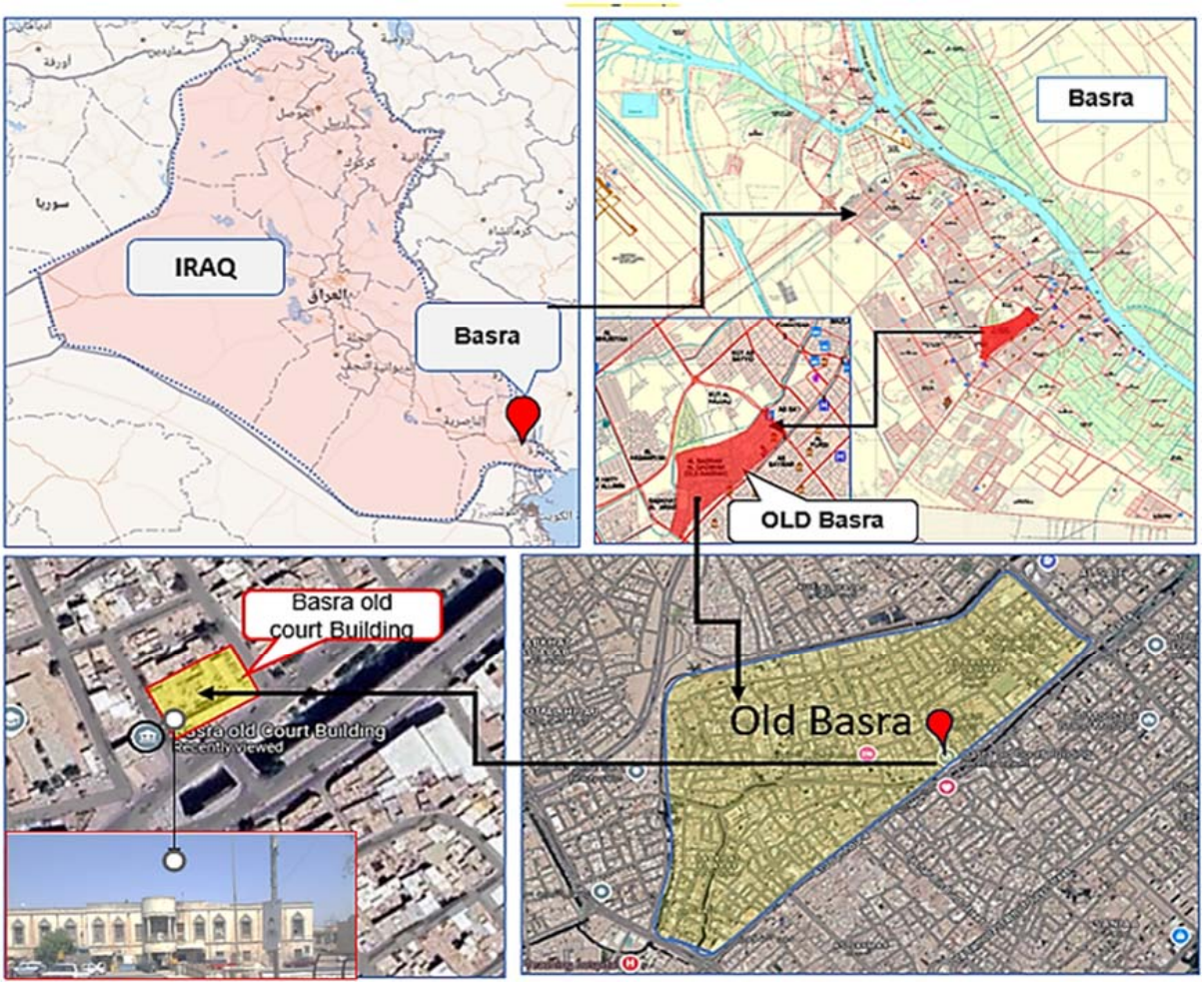


Fig. 5. Case Study Location - Basra Municipality Documents & Google Maps

Fig. 6. The current status of the old court building, photos were taken by researchers

and became an illegal accommodation after the 2003 war, with distorted facades, window details, and building materials (Fig. 6) (Mohammed and Al-Halfawi, 2021). ***Fifth, social value*:** The building is considered a symbolic landmark that reflects the cultural identity and continuity of the collective memory of Basra city (Kalman, 1980). Fig. 7 shows the case study's 2D schemes, the ground floor and the first floor, drawn using the AutoCAD program.

Methodology

The current research methodology is divided into stages to thoroughly investigate the use of VR technology in documenting heritage buildings. It is structured around a sequential mixed methods approach and a case study, as illustrated in (Fig. 8). The methods used are:

Desktop Analysis: This stage involved collecting data at two levels. The first level included analysing relevant literature to extract indicators, variables, and sub-variables that show the VRd in documenting heritage buildings (see Table 1) and review VRd technologies. The second level involved collecting secondary data for the chosen case study (Basra Old Court), relying on aerial surveys and photography. The authors used AutoCAD, Rivet, and Lumion programs to create two 3D models representing two conservation policies. The first model (VR model I) retained the building's original appearance and reconstructed it according to the traditional previous vision, see (Fig. 9). The second model (VR Model II) proposed documenting the court building in the modern style by adding heritage elements to the windows, namely the shanshil, see (Fig. 10). Both models were used in the VHP.

Questionnaire: The second and third stages include conducting questionnaires distributed online on social media included a VHP link. Both questionnaires were answered using a three-point Likert scale (Agree = 3, Neutral = 2, Disagree = 1). The second stage questionnaire was built based on the extracted variables and sub-variables from the literature review. It was directed to 20 random architecture and urban design experts to determine which conservation policy they would choose. The third stage questionnaire, built based on the results of the previous stage, was directed to residents

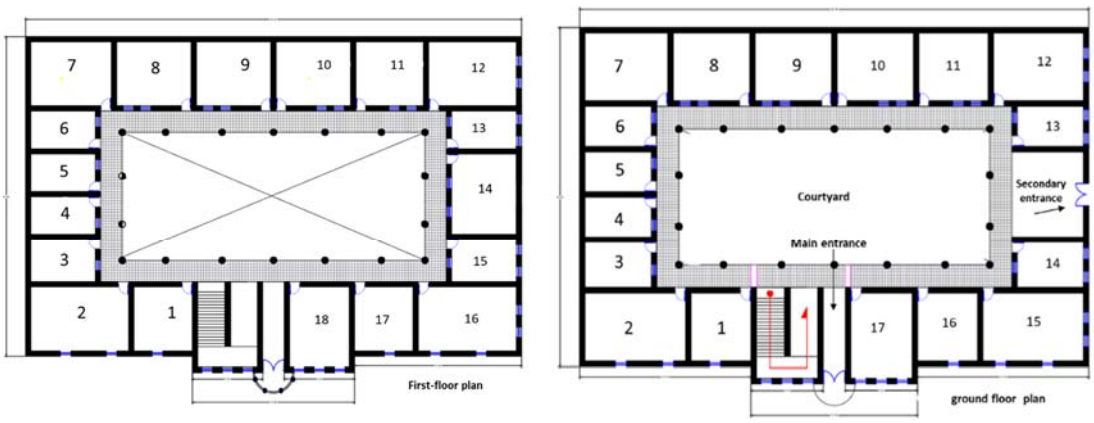


Fig. 7. The plans of the old court building were recreated using the AutoCAD program by researchers

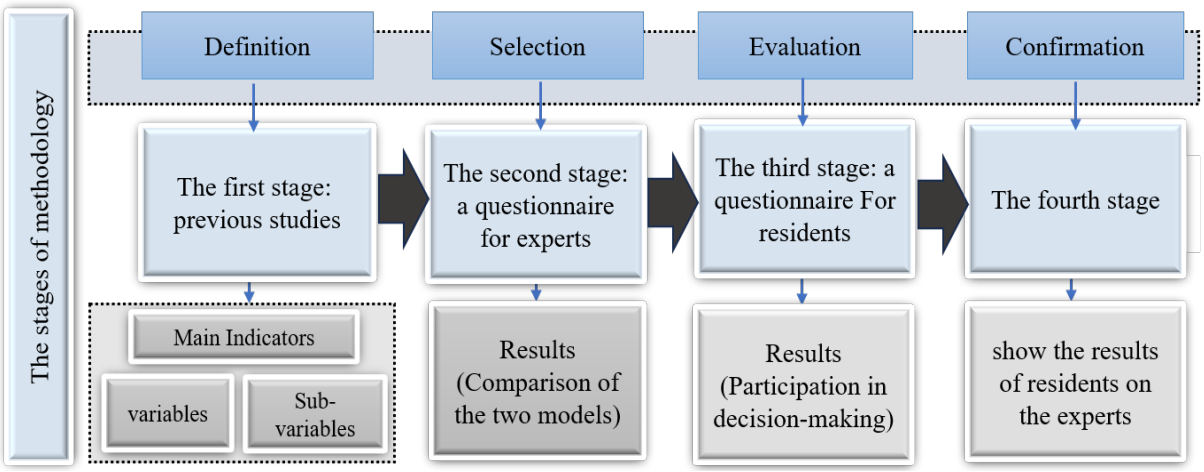


Fig. 8. The research methodology, done by researchers

Fig. 9. VR model I

Fig. 10. VR model II

(157 residents) and examined their satisfaction with the conservation policy the experts chose. The results of this questionnaire justify the research by demonstrating the effectiveness of VR technology in assisting experts in determining the appropriate conservation policy for heritage buildings. The results of both questionnaires were analysed using SPSS.

Virtual Heritage Platform (VHP): This platform was selected for its availability and ability to demonstrate the proposed VR models interactively to participants. It was named after the case study (Basra Old Court). The authors created two VHPs to present the proposed models to experts and residents separately (Figs. 11–12). One of the VHPs demonstrated both VR models for experts, while one VR model was included in the VHP designed for residents.

Results and Discussion

The results analysis of the experts' questionnaire

The data analysis depended on calculating the response percentages of sub-variables under their related variables. The first indicator, "General trends for dealing with heritage buildings virtually", has three variables. Regarding reconfiguring the court building's use (A1), (Fig. 13) shows that the sub-variable A11 obtained an approval rate of 75 % from experts. In contrast, the sub-variable A12 achieved an approval rate of 35 % for restoring the court building's original function. These response rates indicate that the experts agreed with possibly changing its use to another purpose instead of its original no longer needed function. The figure also shows that the sub-variables A21 and A22 have achieved approval rates of 45 % and 55 % for reconfiguring the shape (A2). The higher rate was for the experts' preference for adding detailed elements to the building's traditional facades.

On the other hand, for reconstruction direction (A3), the sub-variables A31 and A32 have approval rates of 60 % and 57.9, respectively. Although the agreement rates were close, the experts agreed to maintain and improve the building's aesthetic

Fig. 11. Virtual Heritage Platform - experts, https://meee-b672c.web.app/

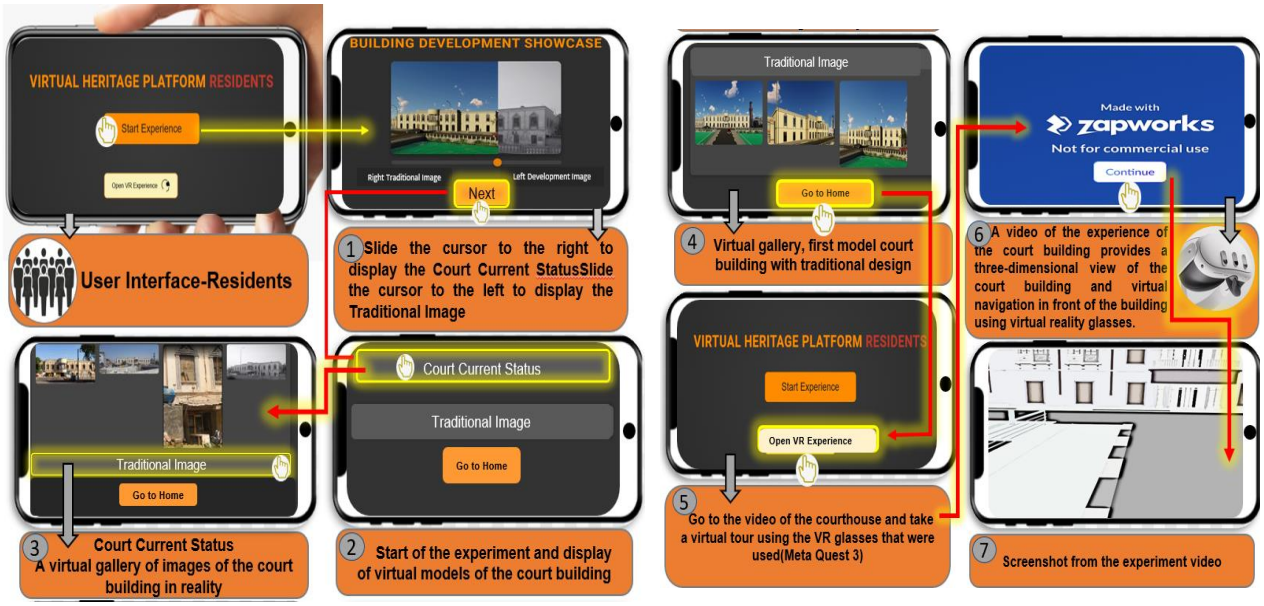
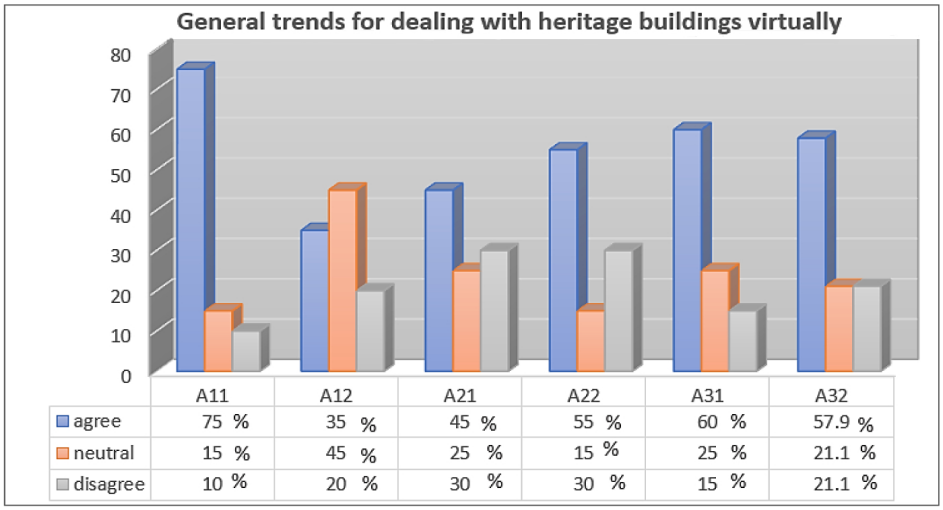


Fig. 12. Virtual Heritage Platform - residents, https://test-689c7.web.app/

value and present its traditional image. Based on the results above, the experts tend to choose the traditional image to preserve the court building, as shown in VR model I.

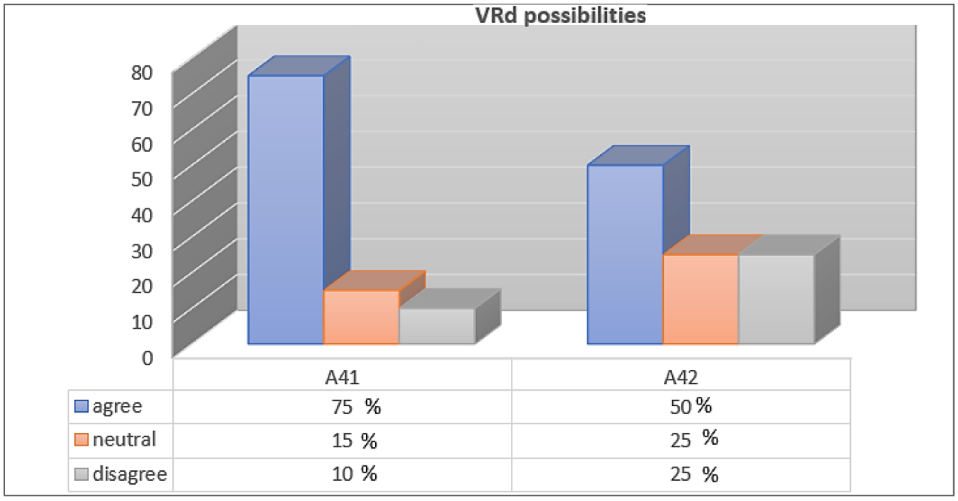
The second indicator, "The VRd possibilities", has one variable, which is Structural evaluation of the heritage building (A4). Regarding (Fig. 14), the sub-variable A41 received an approval rate of 75 %, while A42 and A43 received 50 % each. These rates indicate the experts' agreement on the necessity of VRd for the court due to its poor structural condition to preserve the building's heritage. The results show the importance of preserving the heritage building.

The third indicator, "The VRd considerations", has five variables. Regarding *credibility* (A5), (Fig. 15) shows that the sub-variables A51 and A52 recorded an agreement rate of 60 % each. This indicates the acceptance of the proposed VR models' role in conveying the details of the heritage building by maintaining accurate and close-to-reality representations (A51) and reflecting its function and heritage (A52). For *flexibility* (A6), the figure illustrates that the sub-variable A61 obtained a positive rate of 60 %. This indicates experts' agreement on accepting changes in the court building's form proposed by the VR model II. The



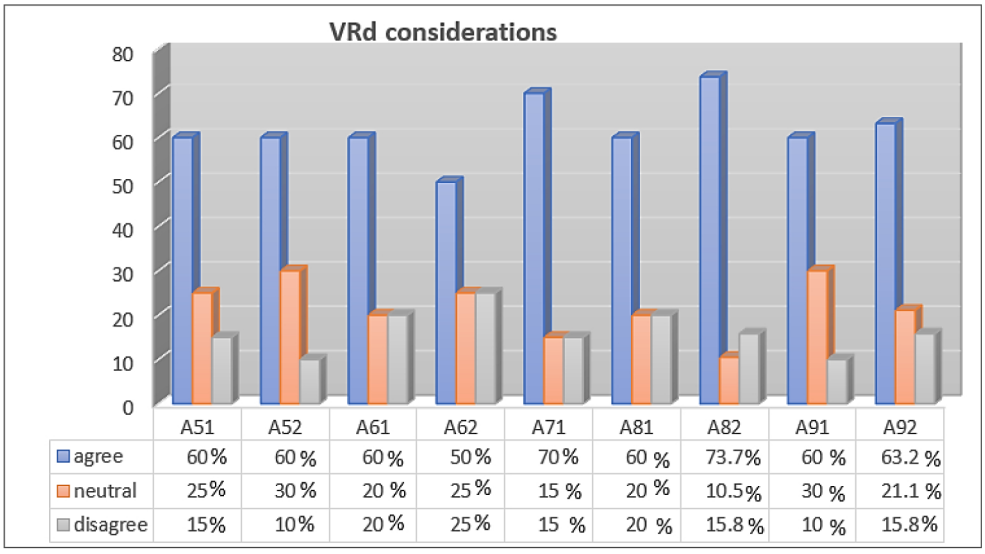
	A11	A12	A21	A22	A31	A32
agree	75 %	35 %	45 %	55 %	60 %	57.9 %
neutral	15 %	45 %	25 %	15 %	25 %	21.1 %
disagree	10 %	20 %	30 %	30 %	15 %	21.1 %

Fig. 13. The results of the first indicator



	A41	A42
agree	75 %	50 %
neutral	15 %	25 %
disagree	10 %	25 %

Fig. 14. The results of the second indicator



	A51	A52	A61	A62	A71	A81	A82	A91	A92
agree	60%	60 %	60 %	50%	70%	60 %	73.7%	60 %	63.2 %
neutral	25%	30 %	20 %	25%	15 %	20 %	10.5%	30 %	21.1 %
disagree	15%	10%	20 %	25%	15 %	20 %	15.8 %	10 %	15.8%

Fig. 15. The results of the third indicator

sub-variable A62 received a 50 % agreement rate regarding the change in the building's function.

In terms of *the level of detail* (A7), A71 achieved an agreement rate of 70 %, indicating experts' agreement on the compatibility of adding new architectural elements with the building's traditional image. For *the perceived value of the heritage item* (A8), the sub-variable A81 received an agreement rate of 60 %. This rate shows that the experts agreed with the clarity of the heritage value of the building, represented by VR I and II models. In comparison, A82 achieved an agreement rate of 73.7 %, representing that the experts also agreed with the proposed heritage and modern value sets in the VR I and II models. *Regarding the complementary elements of the resulting model* (A9), the sub-variables A91 and A92 achieved 60 % and 63 % agreement rates, respectively. Experts' opinions were compatible with both VR models I and II. They preferred the representations in VR model II (A92) more than those representing heritage elements as live images of the building's reality in VR model I (A91). Based on the previous discussed results of A6, A7, and A9, the experts tend to choose the VR model II.

The fourth indicator, "Representation of the heritage building's historical significance in VR", has three variables. Regarding the building's construction time and historical age (A10) and the building's architectural and aesthetic value (A11), (Fig. 16) shows that the sub-variables A101 and A111 obtained an agreement rate of 55 % each. This indicates that the experts agreed on the ability of the VR model I to preserve the temporal dimensions of the heritage building and represent its aesthetic value in its traditional form. However, only 45 % of the experts agreed with the VR model II to enhance the aesthetic value of the building in its contemporary form. For the variable "changing the reading of the building for having heritage events reflected in its proposed VR models" (A12), the experts agreed by 60 % with the sub-variables A121 and A122. The percentage indicates a change in the reading of the building between the traditional and contemporary forms at the levels of the site, its relationship to the place (A121), and the added detailed treatments (A122).

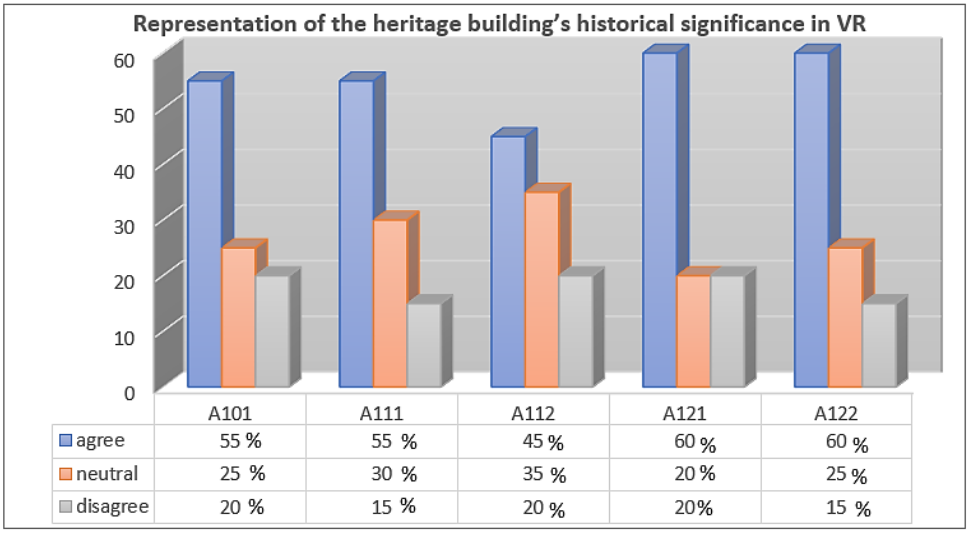
The fifth indicator, "Virtual heritage documentation techniques", has one variable: simulation (A13). In terms of realistic simulation, (Fig. 17) shows that the sub-variable A131 gained 65 % of the agreement rate, while they agreed with A132 and achieved 55 % of the agreement rate. These results demonstrate that the experts preferred conserving the heritage building to match its original traditional image. In other words, they chose the VR model I rather than the VR model II.

In conclusion, the results of the experts' questionnaire indicate that the experts chose the court building's VR model I as a conservation policy to maintain its original shape without additions.

The results analysis of the residents' questionnaire

The residents' questionnaire was built using Google Forms based on the results of the experts' questionnaire. There were 157 total answers representing various age groups, genders, and educational levels. The fewer responses were because this could be their first time participating in an online survey. The data was analysed using SPSS, and answer percentages for five questions were calculated.

As shown in Table 2, 78.4 % of the residents agreed with the first question regarding choosing the VR model I proposed to conserve the court building. For the second question, 67 % of the respondents agreed that VR model I reflected part of the Basra ancient heritage, while 18.4 % of them disagreed.



	A101	A111	A112	A121	A122
agree	55 %	55 %	45 %	60 %	60 %
neutral	25 %	30 %	35 %	20 %	25 %
disagree	20 %	15 %	20 %	20%	15 %

Fig. 16. The results of the fourth indicator

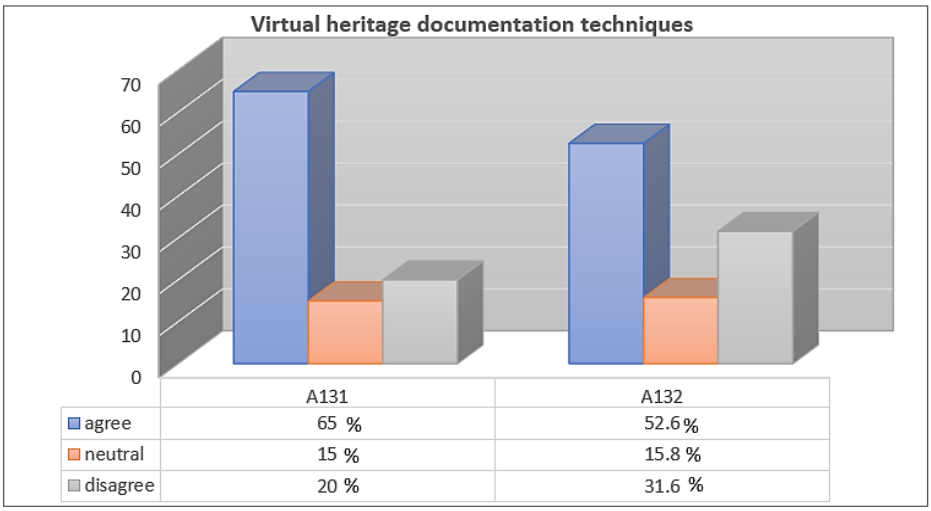


Fig. 17. The results of the fifth indicator

This indicates that around two-thirds of the examined residents knew the city's heritage buildings. However, 33.1 % of the examined residents still need to gain cultural knowledge about the city's heritage buildings. Concerning the third question, around 59 % of respondents agreed that the proposed VR model I consistent with the surrounding area. Nevertheless, 18.5 % of the respondents disagreed with its ability to be compatible with the surrounding area, while 22.9 % of respondents were neutral with their answers. The higher rate of responses to the first and third questions is compatible with experts' opinions in selecting VR model I.

For the fourth question, 93 % of respondents expressed their willingness to participate in future decision-making about heritage buildings in Basra City. This high level of community engagement reflects the importance of community participation in selecting development policies for heritage buildings. It fosters optimism about the future of heritage conservation in Basra City.

In conclusion, the results confirm the residents of Old Basra's alignment with the expert evaluations in the VR model I. In other words, the results of the residents' questionnaire affirm the suitability of the selected conservation policy by experts, which leads to its assistance to experts in their work field.

Conclusion

- The proposed models presented by the case study highlight the role of VR in shaping heritage and enabling realistic documentation and future vision. This gives designers a high potential to digitally preserve the heritage and make informed decisions regarding appropriate changes, thus avoiding sudden real-world changes without realizing the negative impacts that could diminish the building's heritage significance.

Table 2. **Residents' Questionnaire Results**

Questions		Answers					
		Agree		Neutral		Disagree	
		No.	Percentage	No.	Percentage	No.	Percentage
Q1	Based on images of the old court building, what do you think about the building's model as a proposal for restoration?	122	77.7 %	25	15.9 %	10	6.4 %
Q2	Does the attached image of the building on the platform reflect part of Basra's ancient heritage?	105	66.9 %	23	14.6 %	29	18.5 %
Q3	Do you find that the proposed restoration for the court building is consistent with the surrounding area?	92	58.6 %	36	22.9 %	29	18.5 %
Q4	Would you like to participate in future decision-making about the heritage buildings in your city?	146	93 %	10	6.4 %	1	0.6 %
Q5	What is your experience assessment of the platform in viewing the heritage buildings images of your city?	Good		Average		Poor	
		No.	Percentage	No.	Percentage	No.	Percentage
		134	85.4 %	20	12.7 %	3	1.9 %

- The high potential of VR in providing credibility and flexibility in digitally interacting with the building allows for precise changes that align with the reality of the heritage structure.
- The VR is an influential factor in shaping and documenting heritage, utilizing the features of virtual programs that enhance and enable multiple options for original documentation or formalism review for reconstruction and utilization.
- Digital documentation processes can be applied to all the heritage building's structural conditions, whether deteriorating or incomplete. It can also provide a developmental vision for the worn-out heritage structure to present a new contemporary image, thus giving it longevity.
- The documentation process accurately reveals the heritage dimensions, including the building materials, the surrounding external environment, and even the building's history. This allows designers and viewers to perceive the building's realistic image, making it a continuous landmark connected to its time and place.
- The role of VR is to improve the image of the future vision of the building before reformulating and implementing the possible possibilities in formulating heritage buildings. VR helps decision makers make the correct design decision before implementation and helps revive heritage in possible forms.
- VR can play a crucial role in preserving our collective heritage. Its power extends beyond preservation to serve as an educational tool, reminding society of the importance of buildings damaged or lost throughout history due to human, technological, or environmental factors.
- Enhancing the community's participation in decision-making regarding selecting the development policy for heritage buildings that suit its needs increases the sense of community and the preservation of its historical heritage.
- This reflects the role of VR in helping architects and urban designers document the heritage building through digital platforms for virtual documentation that facilitated the exploration of the court building. It also enhances interaction and immersion through a virtual exhibit that includes images and videos of the building viewed through virtual reality goggles.

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РОЛЬ ВИРТУАЛЬНОЙ ДОКУМЕНТАЦИИ В РЕФОРМИРОВАНИИ НАСЛЕДИЯ ГОРОДА БАСРЫ

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Аннотация

Введение. Технология документирования виртуальной реальности может помочь городским дизайнерам и архитекторам изменить форму зданий, являющихся объектами культурного наследия, особенно в городе Басра. **Цель исследования.** Представить технологический потенциал технологий виртуальной реальности (VR), позволяющий оживить эти здания. **Методы.** Теоретический анализ соответствующих исследований, касающихся документации виртуальной реальности и ее технологий. В качестве примера для исследования было выбрано здание старого суда Басры. Также были подготовлены две анкеты, которые были распространены в Интернете, включая ссылку на платформу виртуального наследия (VHP). Первая анкета была направлена двадцати архитекторам и городским дизайнерам, выбранных методом случайного отбора, чтобы определить соответствующую политику сохранения для данного примера в зависимости от их профессионального мнения. Другая анкета была направлена 157 жителям для подтверждения результатов. Кроме того, в качестве инструментов цифровой документации для документирования тематического исследования использовались программы AutoCAD и Revit, в результате чего были созданы две VR-модели, представляющие две политики сохранения природы (традиционную и эволюционную). **Анализ данных** показал, что эксперты и жители предпочли VR-модель № 1 здания, сохраняющего свой первоначальный вид без дополнений. **Заключение.** Такой подход позволяет изучить выбранную стратегию сохранения объекта наследия еще до стадии реализации.

Ключевые слова: документация виртуальной реальности (VRd); объекты культурного наследия; виртуальное наследие; моделирование реального процесса; эволюционное моделирование.