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Using Augmented Reality to Improve Tourism Marketing Effectiveness

Alaa Aggag [1,*] and Wael Kortam [2,*]

[1] Faculty of Business Administration, Arab Academy for Science, Technology and Maritime Transport, El Horreya, El Moshir Ismail Street , Cairo P.O. Box 2033, Egypt
[2] Advanced Marketing Research Centre, The British University, El Sherouk City 11837, Egypt
* Correspondence: alaa.bus0523@miuegypt.edu.eg (A.A.); wael.kortam@bue.edu.eg (W.K.)

Abstract

This study investigates the impact of web-based augmented reality (Web AR) on destination visit intention through the lens of a stimulus–organism–response (SOR) framework, a technology acceptance model (TAM) and flow theory into an integrated theoretical framework. This study aims to address gaps in the literature by providing insights about the relevance of augmented reality to tourism marketing effectiveness. Structural equation modeling was used to test this conceptual framework using AMOS23 on quantitative data collected from questionnaires distributed locally and internationally and applied to 384 participants after going through a Web AR destination experience. The findings confirmed that Web AR stimuli (i.e., interactivity and vividness) positively impact tourists' destination visit intention through the tourist organism in terms of perceived ease of use, perceived usefulness, perceived certainty, perceived enjoyment and perceived immersion. Therefore, the promotion of destinations through augmented reality technology contributes to the development of sustainable tourism. The findings of this study will shed light on an alternative idea for destination marketing to inspire destination management organizations (DMOs) wishing to develop a competitive edge and win within the tourism industry. The results thus contribute to the Web AR and the tourism marketing literature by providing theoretical guidance through a framework for the AR tourism experience, as well as a reference for DMOs.

Keywords: tourism marketing; Web AR; sustainable marketing; technology acceptance theory; stimulus–organism–response theory; flow theory; destination visit intention

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Academic Editor: Colin Michael Hall

Received: 20 May 2025
Revised: 19 June 2025
Accepted: 20 June 2025
Published: 22 June 2025

Citation: Aggag, A.; Kortam, W. Using Augmented Reality to Improve Tourism Marketing Effectiveness. *Sustainability* **2025**, *17*, 5747. https://doi.org/10.3390/su17135747

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1. Introduction

Augmented reality as a potent tool can be harnessed to propel the tourism domain toward a more sustainable future. The main goal of any destination is to drive economic growth and build a sustainable competitive advantage [1]. Economics is thought of as a third pillar of sustainability, along with social and environmental pillars [2]. From an economic perspective, augmented reality could support sustainable tourism growth through increasing the number of tourists. Furthermore, augmented reality can educate tourists through immersive experiences about environmental protection, ensuring that all tourism activities align with environmental conservation standards [3]. Augmented reality is a technology that combines the real world with digital computer-generated objects that are overlaid into the real world [4]. Hence, technology pioneers have described the phenomenon of supplementing the physical world with the digital world as "phygital" [5].

Before 2007, the practical application of augmented reality was confined only to specialists; however, by 2009, companies started to actively study how they can leverage augmented reality to design a novel marketing experience [6]. Traveling is definitely a journey full of experience. This experience usually starts prior to visiting a specific destination; tourism providers usually start at this early stage to influence people's behavior through advertisements to make them want to visit a tourism destination [7]. Eventually, augmented reality technologies can become tourist guides and a main reference for extracting information about tourism destinations, which can help tourists with the selection process. During the decision-making process, the augmented reality technological features such as the vivid display of products/services, as well as the interaction, act as stimuli, evoking positive cognitive and emotional states, eventually leading to behavioral intentions [8]. It can be considered that both interactivity and vividness are the most representative characteristics of augmented reality [9–11]. The SOR paradigm explains the connections between environmental external stimuli, user psychological responses and the resultant behavioral outcome [12]. The SOR model is appropriate when examining the technological features of augmented reality on user experience [13,14]. It can be utilized effectively in the tourism context [15].

The literature regarding immersive technologies, such as AR and VR [16], is growing. Yet, the academic research regarding the use of immersive technologies, specifically in tourism, seems to be overlooked [17]. This situation indicates a need to understand the benefits that augmented reality technologies would bring to the tourism industry. Furthermore, this study addresses a significant limitation pointed out in the previous research, explicitly the difficulty of individuals in installing the augmented reality application [10]. Hence, this study will introduce a more accessible solution to users through the Web AR where users can easily access the augmented reality experience without installing applications; this will give companies a greater universal reach and even greater consumer engagement [18,19]. By utilizing Web AR, DMOs can guarantee that their digital content will spread worldwide, as it is known for its inherent accessibility capabilities [20]. In this study, a Web AR experience was designed to fully understand its impact on tourists' destination visit intention. In detail, interactivity and vividness were applied as attributes of Web AR, with the intention to reveal their effect on tourists' internal states and intentions. Previous researchers advised that it is essential to integrate more than a single theoretical model to better understand a new technology [21]. Thus, this study combined TAM, S-O-R and flow theory into a unified model. A prior study integrated the previous models but in a virtual reality context [9]. Nevertheless, the use of AR specifically in tourism has been admired more than VR [22]. Moreover, this study contributes to the tourism marketing literature, specifically at the destination level, by investigating the role of Web AR in improving its effectiveness. This paper is organized as follows: first, the literature on AR and its relevance to tourism marketing effectiveness is reviewed and a conceptual model is constructed; afterwards, research hypotheses are formulated; then, the method part of this study is explained. Next, data are analyzed and results are conveyed. Finally, discussions on the findings, contributions and limitations of this study are presented.

2. Theoretical Background

2.1. Augmented Reality: A Game Changer in the Landscape of Tourism Marketing

Many studies have claimed that augmented reality is a powerful and effective marketing tool that not only contributes positively to tourists' experiences but also attracts their attention and allows their participation [23,24]. Indeed, the tourism industry confronts pressing challenges such as the negative environmental impact on destinations. Thus, augmented reality emerges as a pivotal tool to foster more sustainable tourism. In addition

to its efficiency as a marketing tool to increase destination visit intention, its adoption in the tourism industry can also inspire tourists to follow more sustainable practices [3]. There is growing evidence that immersive technologies like augmented reality offer a pioneering approach to sustainable tourism development [3]. Specifically, augmented reality can empower DMOs to define how tourists can interact with the destination in order to minimize the impact of travel on the environment. Accordingly, augmented reality technology could drive sustainable tourism growth not only from an economical aspect but also from an environmental aspect. At its core, augmented reality's main value subsists at the pre-booking phase. Since AR can allow tourists to visualize the destination [25], this stage is referred to as a "dreaming stage", where prospective travelers are fantasizing about their upcoming vacation while searching for different destinations [26]. In this stage specifically, destination marketing organizations should immediately seize the opportunity and use augmented reality to inspire prospective travelers through a novel and eye-catching personalized experience. To elaborate more, the tourist starts with the planning of the holiday and tries to acquire information about several destinations, which is a very crucial step, since traveling to a new tourism destination without a direct trial can increase tourists' anxiety. Consequently, the inclusion of the perceived certainty (PC) variable in the S-O-R is deemed necessary. Therefore, this study expanded the model to understand the ability of AR in increasing tourists' perceived certainty. AR can influence tourists' subjective well-being and give them the sensation of actually going through a destination tour. Accordingly, the adoption of augmented reality in marketing for destinations is becoming essential. AR offers substantial potential in the sale of tourism products [23]. AR technology is acknowledged to be able to enhance the effectiveness of digital marketing [27]. However, there is a lack of empirical studies to acquire a deeper understanding of how the use of AR will affect tourists' behavior [28]. Thus, measuring the destination visit intention through Web AR is considered to be valuable. This study will mainly focus on Web AR. Although Web AR is still in its infancy stage, especially in the tourism industry, the results of this study will provide references for researchers and tourism providers.

2.2. The Relevance of Augmented Reality to Tourism Marketing Effectiveness

The impetus of this research is to discuss the issue of tourism marketing and suggest ways to enhance its effectiveness. The question regarding tourism marketing effectiveness has become a critical issue in terms of how the marketing activities affect tourists' behavior [29]. Similarly, the expenditure of DMOs on tourism marketing has prompted ongoing debates. Since implementing augmented reality in the tourism sector requires a high level of investment [3], it is of paramount importance to answer the following important question: to what extent does the implementation of augmented reality promote the improvement of tourism marketing effectiveness? DMOs consider other psychological and cognitive aspects, including tourists' visit intention [29], to assess the effectiveness of tourism marketing. Tourists' future visit intention is among the steps of the travel decision-making process [30]. Therefore, it is essential to delve into how experiencing augmented reality can influence prospective tourists' intentions to visit a certain destination. The critical issue of how augmented reality attributes impact tourists' destination visit intention through integrating TAM, SOR and flow theories has gained less attention. This study enriches the existing research on tourism marketing effectiveness within a new and emerging scope of immersive technologies called Web AR.

2.3. The Technology Acceptance Model, Stimulus–Organism–Response Model and Flow Theory

This research has considered the technology acceptance model (TAM), stimulus–organism–response model (S-O-R) and flow theory as the theoretical foundation. Several

studies have used TAM since it is a practical framework used to show how tourists accept and use a technology in the context of immersive technologies [31–34]. Studies have frequently used TAM to inspect behavioral intentions of tourists related to augmented reality, including tourists' impulsive buying behavior [33], predicting tourists' attitude and usage intention toward AR-marketed attractions [35] and examining the potential of AR in urban heritage tourism [36]. Since augmented reality is a new technology, most studies between 2012 and 2018 utilized the technology acceptance model to examine its adoption and user acceptance [37]. Prior studies show that TAM is considered a suitable tool for examining the behavioral intentions of tourists in an augmented reality context. To understand tourists' perception regarding augmented reality and its impact on their behavioral intention, TAM was operationalized in this study. The two main elements of TAM, perceived usefulness and perceived ease of use, were utilized in this study. Scholars have suggested the importance of including hedonic qualities into the original TAM [12]. The limitation of TAM is not providing a complete assessment of augmented reality, ignoring its important immersive characteristics that shape users' behavioral intention, as well as the absence of the hedonic state of the user. To address both limitations, the present study integrates the original TAM, the stimulus–organism– response (SOR) model and the flow theory to develop a new research model for examining the impact of augmented reality attributes on tourists' intention to visit a specific tourism destination.

Flow theory signifies a user's experience flow when he/she is immersed and absorbed in particular activities in which he/she is not only highly focused upon and experiencing enjoyment but also failing to track time [12,38]. Huang and Liao mentioned that, when people are exposed to interactive technologies, they perceive the passage of time as extremely fast. Multiple studies have utilized the flow theory, especially in tourism contexts related to immersive technologies [9]. Moreover, theory-based research related to immersive technologies has revealed that the flow theory and the technology acceptance model are the most used in the tourism context [39]. Accordingly, it is considered effective to use the two main dimensions of flow theory, namely perceived immersion and perceived enjoyment.

Woodworth introduced the SOR model in 1929 to examine the effect of the environment on individuals' behavior [40]. The SOR model consists of the stimulus (S), which could be marketing tools that marketers use to motivate consumers to purchase and impacts individuals' cognitive and affective processes (O), which then leads to responses (R), (referred to as behavioral intention) [41]. This study extends the SOR theory to test the possible influence of perceived certainty on destination visit intention. The addition of perceived certainty is considered necessary, since perceived certainty is appropriate when investigating tourists' behavioral intentions [42]. Therefore, by adding the perceived certainty variable, it is aimed to understand how the augmented reality experience overcomes tourists' decision insecurity and increases their perceived certainty about a particular destination. The S-O-R paradigm has been extensively used as a solid foundation in augmented reality context [13,14]. Predominantly, this study chose the S-O-R model as a frame for its ability to effectively understand how the attributes of Web AR (interactivity and vividness), which act as external stimulators, can influence tourists' organism constituents (perceived usefulness, perceived ease of use, perceived certainty, perceived enjoyment and perceived immersion) in prospective travelers and eventually their response (destination visit intention).

3. Hypotheses Development

This study examines two aspects of augmented reality characteristics—interactivity and vividness—as stimuli in the SOR paradigm, which elicits travelers' destination visit intention as a response through the cognitive state, where the original components of TAM are incorporated, namely perceived usefulness, perceived ease of use and perceived certainty; and affective state, namely perceived enjoyment and perceived immersion of flow theory as an organism.

Interactivity is defined as "the extent to which individuals can take part in modifying the content of a mediated environment in the present time" [43]. Interactivity has three features including (1) the speed of the interaction, where the users' actions can instantaneously make changes in the mediated environment; (2) the range of interactivity, where there are multiple ways to modify the displayed content; and (3) mapping, which signifies the extent to which one's actions are connected to actions within the mediated environment [43].

In the tourism sector, interactivity fosters the perceived ease of use of online destination marketing, which deepens the customer experience [33]. Perceived ease of use occurs when a user believes that a certain system is easy to use and requires minimal effort [44]. The interactive components of immersive technologies, such as dragging virtual objects or zooming, allows individuals to gather information with minimum effort [9,45]. Previous studies have stated that there is a significant effect of interactivity on perceived ease of use not only in online shopping but also in various contexts [36,46]. In this situation, this study proposes the following:

H1a. *Interactivity of Web AR positively impacts perceived ease of use.*

A system is more likely to be used in the future when it is believed by users that it can actually bring them value [47]. In an AR context, the interactive features enhance users' information processing and enhance their knowledge about the displayed product/service [48]. The interactive features of immersive technologies enable users to not only navigate the virtual environment but also to modify it [49]. Accordingly, by improving the response time of the visual information, users feel that they actually gained more information than from static videos [9,45]. In other words, interactivity provides prospective tourists an opportunity to live in the mediated environment that is typical of the real destination before actually traveling to it. Hence, the interactivity features of AR technologies determine perceived usefulness [46]. So, this study suggests the following:

H1b. *Interactivity of Web AR positively impacts perceived usefulness.*

The psychological experiences of distrust and uncertainty in the tourism context can be defined as perceived uncertainty that can definitely impacts tourists' willingness to travel [50]. According to a study conducted in Australia, immersive technologies have become essential tools that tourism suppliers should use in order to reduce prospective tourists' perceived uncertainty when selecting a destination [51]. Hence, the importance of the interactivity feature of augmented reality lies in its ability to provide extensive knowledge about the destination to tourists, which increases their certainty [42]. The main cause of the perceived product uncertainty is the difficulty associated with the evaluation of intangible products promoted online [52]. The interactivity feature of augmented reality has successfully overcome this issue [53]. According to a study conducted by [54], interaction has a negative effect on perceived uncertainty in E-commerce contexts. Hence, this study proposes the following:

H1c. *Interactivity of Web AR positively impacts perceived certainty.*

Perceived enjoyment refers to the degree to which using a certain system is perceived as enjoyable in its own right, separate from any performance outcome resulting from using it [55]. The more interactive features in computer games, the higher the enjoyment level that users experience. Similarly, users experience enjoyment when exposed to functional elements such as interactivity [10]. Prior findings insist that the interactivity of immersive technologies induces users' perceived enjoyment [9,56], and it has been shown that the interactivity of augmented reality provided through mobile applications is expected to provide users with not only entertaining but also playful experiences [46]. This study hypothesizes that:

H1d. *Interactivity of Web AR positively impacts perceived enjoyment.*

Perceived immersion makes users feel that they are "really here" [16]. Consequently, the interactivity features make users feel immersed and absorbed in the mediated environment by allowing active participation [10,48,56]. Such immersive technologies can make users feel immersed in the destination displayed and even increase impulsive desires to actually visit the destination [57]. The interactivity of AR technologies can impact users' perceived immersion [10]. Based on such arguments, this study suggests that:

H1e. *Interactivity of Web AR positively impacts perceived immersion.*

Vividness is associated with the overall quality of the product display [10]. Users' perception of ease of use of technology can be improved when they better capture all the details of the displayed product [58]. In an AR context, vividness, such as clarity and well-defined displays, has a positive effect on users' perceptions of the ease of use of technology [9,46,58,59]. Therefore, this study suggests the following hypothesis:

H2a. *Vividness of Web AR positively impacts perceived ease of use.*

Prior studies allude that the greater the vividness on a website, the greater the users' ability to gather information due to the ability to see a well-defined demonstration of a product [46]. It has been conceptualized that augmented reality technology assists users by increasing their knowledge in many contexts, including the consumption context, because of the 3D visualization that provides users with a richer experience. Vividness enhances users' perceived usefulness of technology [9,46,59,60]. These arguments lead to the subsequent hypothesis as follows:

H2b. *Vividness of Web AR positively impacts perceived usefulness.*

Vivid product/service display includes more human senses [54]. Web AR in tourism can provide not only visual senses but also auditory senses. Vividness of displayed products can be provided through multi-sensory channels that can better shape users' experience [61], therefore increasing product certainty. Vividness can compensate for other missing senses to experience tourism in virtual reality contexts [62]. Additionally, vividness helps in increasing users' understanding of product quality in an augmented reality context [63], thereby offering a chance for trust building [54]. Furthermore, augmented reality can effectively reduce uncertainty in online shopping [64]. Moreover, vividness has a negative impact on perceived uncertainty [54]. Therefore, this study proposes that:

H2c. *Vividness of Web AR positively impacts perceived certainty.*

Users who experience more vivid 3D images have a higher level of enjoyment compared with those experiencing 2D images [10]. Furthermore, within the online environment, when users are exposed to augmented reality with media features that provide them with more vivid visualizations of products/services, they develop a rich and enjoyable experience [46]. In the same vein, the vividness of the augmented reality technology positively impacts users' enjoyment [10,56]. Therefore, this study hypothesizes that:

H2d. *Vividness of Web AR positively impacts perceived enjoyment.*

The vividness of immersive technologies could enhance users' feeling of immersion [65]. The vivid nature of immersive technologies provides users with an immersive and impressive experience [66]. Similarly, vividness has a positive impact on immersion in the mediated environment [56]. The previous study stated that the significant relationship between vividness and immersion occurs because of the vivid and realistic virtual product/service display that appears as a seamless part of the users' physical environment; with this in mind, this study presents the next hypothesis:

H2e. *Vividness of Web AR positively impacts perceived immersion.*

The perceived ease of use and perceived usefulness of immersive technologies influence tourists' intentions to visit [67]. The previous study highlighted that individuals' perception of immersive technologies as being user-friendly fosters a favorable visit intention; also, the perceived usefulness of immersive technologies has a prominent role in impacting prospective tourists' visit intentions. Furthermore, perceived certainty is an important driver of the behavioral intention due to users' high sense of familiarity. When buyers' perceived uncertainty is high due to the absence of detailed information regarding a particular product, this may hinder their future purchase intention [54]. Moreover, fun, entertainment or enjoyment as positive experiences relate to behavioral intention [68]. Furthermore, perceived immersion as an affective dimension increases behavioral intention [13,69]. Similarly, perceived immersion has a significant effect on destination visit intention [70]. Thus, it is expected that perceived ease of use, perceived usefulness, perceived certainty, perceived enjoyment and perceived immersion of Web AR will play a vital role in shaping tourists' behavioral intention. Based on the above discussion, this study puts forward the following hypotheses:

H3. *Perceived ease of use positively impacts destination visit intention.*

H4. *Perceived usefulness positively impacts destination visit intention.*

H5. *Perceived certainty positively impacts destination visit intention.*

H6. *Perceived enjoyment positively impacts destination visit intention.*

H7. *Perceived immersion positively impacts destination visit intention.*

A conceptual model demonstrating the hypotheses formulated above is depicted in Figure 1.

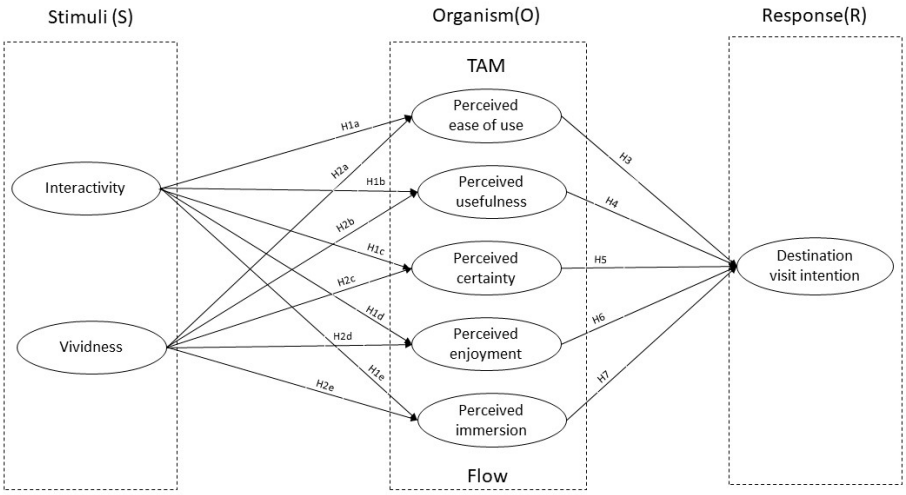


Figure 1. The proposed conceptual model.

4. Research Methodology

A quantitative research approach was chosen in this study to investigate how Web AR attributes enhance tourism marketing effectiveness and influences tourists' destination visit intention. Data were collected quantitatively through questionnaires distributed to a convenient sample of local and international tourists. The data collection occurred over a period of four months (from the middle of September 2024 to the middle of January 2024). Respondents were able to access the augmented reality experience of the "Safaga" destination through a Web AR. In detail, the respondents could simply access the "Safaga" AR experience directly through the camera of their smartphones and web browser. Web AR is gaining more attention than mobile AR applications, simply because it is more convenient, where respondents do not need to download an application on their smartphones [18]. This paper capitalized on the main benefit of using Web AR, which was the reduction in the number of steps to access the augmented reality experience of "Safaga" on the coast of the Red Sea. The quantitative data were analyzed using structural equation modeling. Furthermore, before participating in this study, respondents received some information regarding the Web AR experience to enhance the quality of the data. The foremost limitation of this study stems from the limited budget that hindered the creation of an extensive Web AR experience. Well-informed consent from the participants before their involvement was collected. Participants received a cover letter illustrating the purpose of this study, assuring participants that all personal information remains private to assure confidentiality of the data, and emphasizing the voluntary participation.

4.1. Study Site Profile

The questionnaire starts with an underwater Web AR experience encompassing a sea turtle (Figure A1 in Appendix A) in Safaga on the coast of the Red Sea, located in Hurghada, to show participants its exotic marine life. This underwater experience, which stimulates the visual sense, is inserted to help participants understand the implications of Web AR in tourism and destination marketing. This Web AR experience enables individuals to interact with the sea turtle, including zooming in and out or repositioning it anywhere. This study selected the Safaga underwater experience as the context for this study for multiple reasons. Considered as one of the most striking areas for tourism in the Red Sea location, Safaga is known for its dry climate and its short winter months [71]. One of the most popular diving magazines in the world, the British *DIVE* magazine, indicated in August, 2024 that Safaga is one of the best places worldwide for scuba diving. Moreover, the number of tourists visiting Egypt is booming and is rapidly increasing. According to Statista, the number of

European tourists alone who have visited Egypt is around 7.3 million in 2023. Hurghada and the Red Sea alone attracted 1.5 million tourists in the first half of 2023.

4.2. Design and Sampling

A quantitative research approach was employed to examine how the interactivity and vividness of Web AR influences tourists' destination visit intention through tourists' organism. The main criteria for selecting the sample for the quantitative data collection from participants who had never visited Safaga before was to eliminate those who might have had previous perceptions about Safaga. The previous condition was assigned to help more precisely determine the effectiveness of the Web AR technology on participants' destination visit intention after the Web AR experience, as the participants' previous feelings or perception about Safaga might interfere with the results. Screening questions ensured that the respondents had never visited "Safaga" on the coast of the Red Sea before. A total of 384 questionnaires were completed and collected after taking part in the Web AR experience of "Safaga" (which was placed at the beginning of the questionnaire), which made tourists more familiar with the Web AR experience. Finally, tourists were able to answer the questionnaire based on the Web AR experience of "Safaga". Survey circle and survey swap platforms were used to collect responses from international tourists. The sample size was greater than the minimum 200 participants, which is commonly used for SEM studies (384 > 200) [72]. A structural equation modeling (SEM) approach was used to analyze the data using AMOS23. The first step assessed the reliability and validity for all the research constructs, and the next step provided reliable results for path coefficients through testing the research hypotheses using regression weights based on maximum likelihood estimates.

4.3. Procedure

A non-probability convenience sampling was applied, which is appropriate when the population is nearly finite [73]. As the unit of analysis included both local and international tourists, 384 responses were collected, which exceeded the required sample size, therefore enhancing the validity of the study findings. According to (Table 1), it can be determined that most respondents were female (64.6%) and young travelers (42.7% aged 18–24; 36.5% aged 25–34), who traveled between 1 and 3 times per year (47.1%). The nationalities from other countries, including French, Brazilian, German, Croatian, Belgian, Bulgarian, Russian, Italian, Romanian, Hungarian, Canadian, Austrian, Turkish, Australian, Spanish, Mexican, Ukrainian, Nigerian and Tunisian nationalities, represented (31.7%) and the Egyptian nationality represented 26.3%. This demographic analysis emphasizes that young people who are frequent travelers are shaping their interest and behaviors in immersive technologies, like augmented reality, in tourism.

Table 1. Demographic profile of respondents.

Characteristics	Group/Category	Frequency	Percent
Gender	Female	248	64.6
	Male	136	35.4
Age group	18–24	164	42.7
	25–34	140	36.5
	35–44	66	17.2
	45–54	8	2.1
	55+	6	1.6

Table 1. *Cont.*

Characteristics	Group/Category	Frequency	Percent
Travel frequency	Once a year	136	35.4
	Between 1 and 3 times a year	181	47.1
	More than 3 times a year	67	17.4
Nationality	Egyptian	101	26.3
	American	44	11.45
	British	42	10.9
	Asian	75	19.5
	Other	122	31.7

4.4. Survey Instrument

The structure of the survey was as follows: the first section outlined the aim of this study, followed by a description of "Web AR" accompanied by a link/QR code to view the marine life in Safaga on the coast of the Red Sea through the Web AR. Next, participants were directed to YES/NO questions to filter and end the survey for those who had traveled before to "Safaga" on the coast of the Red Sea. The third section included 35 items measuring the 8 latent variables: interactivity of Web AR, vividness of Web AR, perceived ease of use, perceived usefulness, perceived certainty, perceived enjoyment, perceived immersion and destination visit intention. Vividness was measured with 6 indicators and perceived usefulness was measured with 5 indicators. The remaining six were measured with four indicators each (Table 2). Indicators were written as statements and responses were recorded using a Likert scale with five choices ranging from (1) strongly disagree to (5) strongly agree. All of these indicators were compiled from the previous literature and have been modified to suit the present study. To confirm that the participants understood the survey questions without difficulty, the questionnaire was pre-tested on a convenience sample of 50 participants, which was above the minimum sample size of a pilot study [74]. Respondents were requested to determine where they found difficulty in comprehending the questions. Based on their insights, the researcher changed the wordings and sequence of some questions to make sure that respondents could easily understand questionnaire questions.

Table 2. Summary of elements in the conceptual model.

Constructs	Code	Statement	Source
Interactivity	INT1	I was in control of my navigation through the Web AR.	[10]
	INT2	I had some control over the content (sea turtle) of the augmented reality technology (Web AR) that I wanted to see.	
	INT3	I was in control over the pace (speed) to watch the digital objects (sea turtle).	
	INT4	The augmented reality technology (Web AR) had the ability to respond to my specific needs quickly and efficiently.	
Vividness	VIV1	The visual display (sea turtle) through the AR technology was clear	[10]
	VIV2	The visual display (sea turtle) through AR was detailed.	
	VIV3	The visual display (sea turtle) through AR was vague.	
	VIV4	The visual display (sea turtle) through AR was vivid.	
	VIV5	The visual display (sea turtle) through AR was sharp.	
	VIV6	The visual display (sea turtle) through AR was well defined.	

Table 2. *Cont.*

Constructs	Code	Statement	Source
Perceived ease of use	PEU1	The interaction with the Web AR is clear and understandable.	[75]
	PEU2	The interaction with the Web AR does not require a lot of effort.	
	PEU3	I find Web AR easy to use.	
	PEU4	I find it easy to access the desired information through the Web AR.	
Perceived usefulness	PU1	Through the Web AR, I can more quickly get an impression of Safaga red sea.	[75]
	PU2	Due to the Web AR, I can easily evaluate the Safaga red sea.	
	PU3	By using the Web AR, I can better evaluate Safaga red sea.	
	PU4	I find the Web AR useful to look at Safaga red sea.	
	PU5	Overall, I find that the Web AR is useful to get an impression of Safaga red sea.	
Perceived certainty	PC1	It is likely that this destination meets my expectations.	[76]
	PC2	It is likely that I'm satisfied with this destination.	
	PC3	There is a higher chance that this destination does not disappoint.	
	PC4	Visiting this destination is probably a good choice.	
Perceived enjoyment	PE1	I had fun using Web AR.	[77]
	PE2	Using Web AR provided me with a lot of enjoyment.	
	PE3	I enjoyed using Web AR.	
	PE4	Using Web AR did not bore me.	
Perceived immersion	PI1	Once into the Web AR, I was unaware of what was happening around me.	[65,78]
	PI2	Once into the Web AR, I felt disconnected from outside world.	
	PI3	I felt that I was actually traveling during my experience of Web AR.	
	PI4	During Web AR, I feel in another world.	
Destination visit intention	DV1	Based on my Web AR experience, I will visit this destination in the future	[79]
	DV2	I intend to visit the destination I experienced in Web AR in the near future.	
	DV3	I would not want to visit this destination after this Web AR experience.	
	DV4	I would recommend the destination I experienced in Web AR to others.	

5. Results

5.1. Inner Model/Measurement Model Assessment

The model fit was evaluated via 10 indices: normed chi-square (1.623) with cut-off values less than (5), goodness-of-fit index (GFI) (0.900) that was identical to threshold, adjusted goodness-of-fit index (AGFI) (0.876), normed fit index (NFI) (0.917) that exceeded 0.9, relative fit index (RFI) (0.903), incremental fit index (IFI) (0.966), Tucker–Lewis index (TLI) (0.960), comparative fit index (CFI) (0.966) that exceeded 0.95, root mean square residual approximation (RMSEA) (0.040) that was below 0.10 and root mean square residual (RMR) (0.04) that was below the 0.08 threshold [80] (Hair et al., 2014). Therefore, the confirmatory factor analysis (CFA) analysis depicted a good model fit. Factor loading, composite reliability (CR) and Cronbach's alpha (α) were used to verify the instrument reliability. Factor loadings were at an acceptable level above 0.50 [80], while CR and Cronbach's alpha (α) values were greater than the 0.7 threshold, reflecting an internal consistency (Table 3). The statements containing a factor loading less than 0.50 (Viv3) and (DV3) were excluded from the measurement tool.

Model validity was evaluated in terms of convergent and discriminant validity. The average variance extracted (AVE) turned out to be greater than the 0.50 threshold, except the construct of interactivity, which was considered near to the cut-off value, confirming convergent validity. Moreover, the square root of the AVE of each construct was greater than the correlation coefficient of the specific construct with any of the other constructs, indicating sufficient discriminant validity [81] (Table 4). Yet, the square root of the AVE for perceived

enjoyment (0.707) was less than the correlation coefficient between perceived enjoyment and destination visit intention (0.797), indicating that the two constructs overlapped.

Table 3. Reliability and validity estimates.

Constructs	Code	Factor Loading	CA	(CR)	(AVE)	HTMT
Interactivity	INT1	0.667	0.745	0.746	0.424	0.746
	INT4	0.661				
	INT2	0.640				
	INT3	0.636				
Vividness	VIV6	0.783	0.822	0.858	0.549	0.864
	VIV2	0.775				
	VIV4	0.767				
	VIV1	0.734				
	VIV5	0.635				
Perceived ease of use	PEU3	0.783	0.822	0.806	0.511	0.815
	PEU1	0.729				
	PEU4	0.728				
	PEU2	0.608				
Perceived usefulness	PU2	0.867	0.919	0.918	0.694	0.920
	PU5	0.836				
	PU3	0.834				
	PU4	0.834				
	PU1	0.793				
Perceived certainty	PC1	0.849	0.858	0.871	0.629	0.880
	PC2	0.829				
	PC4	0.781				
	PC3	0.708				
Perceived enjoyment	PE3	0.897	0.905	0.906	0.707	0.914
	PE2	0.862				
	PE1	0.830				
	PE4	0.770				
Perceived immersion	PI4	0.874	0.870	0.855	0.600	0.887
	PI3	0.869				
	PI2	0.681				
	PI1	0.647				
Destination visit intention	DV2	0.868	0.854	0.894	0.737	0.895
	DV1	0.865				
	DV4	0.844				

The heterotrait–monotrait ratio was proposed to assess the discriminant validity [82]. (Table 3) shows that HTMT ratios were below the (0.9) threshold in all research constructs, which means the latent variables had a robust discriminant validity; however, the constructs perceived usefulness and perceived enjoyment exceeded the threshold (0.90).

Table 4. Pearson correlation coefficient and the square root of AVE.

Constructs	Interactivity	Vividness	Perceived Ease of Use	Perceived Usefulness	Perceived Certainty	Perceived Enjoyment	Perceived Immersion	Destination Visit Intention
Interactivity	**0.651**							
Vividness	0.571	**0.740**						
Perceived ease of use	0.556	0.625	**0.714**					

Table 4. *Cont.*

Constructs	Interactivity	Vividness	Perceived Ease of Use	Perceived Usefulness	Perceived Certainty	Perceived Enjoyment	Perceived Immersion	Destination Visit Intention
Perceived usefulness	0.549	0.558	0.403	**0.833**				
Perceived certainty	0.426	0.507	0.574	0.364	**0.793**			
Perceived enjoyment	0.639	0.610	0.627	0.561	0.460	**0.707**		
Perceived immersion	0.456	0.464	0.455	0.410	0.389	0.621	**0.774**	
Destination visit intention	0.644	0.658	0.714	0.696	0.653	0.797	0.634	**0.858**

Notes: The bold values at the diagonal line are the square root of AVE values.

5.2. Outer Model

The structural model was assessed using SEM. The model fit was evaluated via 10 indices: normed chi-square (3.8) with cut-off values less than (5), goodness-of-fit index (GFI) (0.98) that exceeded 0.90, adjusted goodness-of-fit index (AGFI) (0.915), normed fit index (NFI) (0.99) that exceeded 0.9, relative fit index (RFI) (0.94), incremental fit index (IFI) (0.99), Tucker–Lewis index (TLI) (0.95), comparative fit index (CFI) (0.99) that exceeded 0.95, root mean square residual approximation (RMSEA) (0.08) that was below 0.10 and root mean square residual (RMR) (0.02) that was below the 0.08 threshold. All the goodness-of-fit measures of the model were within acceptable thresholds, confirming the goodness of fit of the structural model.

6. Discussion of the Findings

The present paper proposes an integrated conceptual framework to examine the influence of Web AR technological characteristics on tourists' destination visit intention. Although the findings indicate that most of the constructs satisfy the validity criteria, the AVE value of interactivity construct is below the threshold value (0.50), which implies that the indicators may not completely reflect the latent construct. Also, the correlation coefficient between perceived enjoyment and destination visit intention surpasses the square root of the AVE for perceived enjoyment, indicating an overlap between these constructs. Moreover, the HTMT ratios for perceived usefulness and perceived enjoyment exceed the threshold value (0.90), signifying discriminant validity concerns. Generally, the findings of this study reveal that Web AR characteristics (stimuli) play a prominent role in shaping tourists' organism (organism) that drives tourists' destination visit intentions. These results indicate that AR technology has a strong potential to become a new marketing tool used by tourism marketers and DMOs to trigger tourists' destination visit intentions [28]. As is apparent from Table 5, the results of the SEM analysis indicate that H1a-H1e are supported, as it has been revealed that Web AR interactivity positively affects perceived ease of use ($\beta = 0.296$, $p < 0.001$), perceived usefulness ($\beta = 0.342$, $p < 0.001$) and perceived certainty ($\beta = 0.203$, $p < 0.001$), supporting H1a, H1b and H1c, and concurring with prior studies related to augmented reality [46,54,59], respectively. First, if users feel that they have a high level of control over their interaction with a certain technology, as well as being able to complete tasks quickly with less effort, then they will perceive ease of use [33,46,83]. This interactive experience also has been proven to enhance users' understanding in several contexts such as education, work and consumption due to the rich experience of the 3D visualization they receive [10]. This rich and informative sensory environment that provides additional imagery of the destination prior to traveling to it can also enhance

perceived certainty in tourists' decisions. Interactivity negatively affects users' perceived uncertainty [54]. In other words, the interactive feature of AR can boost tourists' decision comfort [42]. Web AR interactivity affects perceived enjoyment (0.436, $p < 0.001$) and perceived immersion ($\beta = 0.284$, $p < 0.001$), supporting H1d and H1e; these results are in concordance with prior studies. Interactivity is a predictor of perceived enjoyment [33] and perceived immersion [9,56]. Web AR provides users with an enjoyable experience as well as a sense of escape through the creation of an immersive simulation of a "mini-trip" to a particular destination.

Table 5. Findings of path analysis.

Relationship	Standardized Path Coefficient (β)	Standard Error	Result
H1a: Interactivity → Perceived ease of use	0.296 ***	0.039	Supported
H1b: Interactivity → Perceived usefulness	0.342 ***	0.044	Supported
H1c: Interactivity → Perceived certainty	0.203 ***	0.051	Supported
H1d: Interactivity → Perceived enjoyment	0.436 ***	0.034	Supported
H1e: Interactivity → Perceived immersion	0.284 ***	0.033	Supported
H2a: Vividness → Perceived ease of use	0.456 ***	0.045	Supported
H2b: Vividness → Perceived usefulness	0.363 ***	0.051	Supported
H2c: Vividness → Perceived certainty	0.393 ***	0.059	Supported
H2d: Vividness → Perceived enjoyment	0.368 ***	0.039	Supported
H2e: Vividness → Perceived immersion	0.302 ***	0.038	Supported
H3: Perceived ease of use → Destination visit intention	0.212 ***	0.023	Supported
H4: Perceived usefulness → Destination visit intention	0.305 ***	0.018	Supported
H5: Perceived certainty → Destination visit intention	0.233 ***	0.018	Supported
H6: Perceived enjoyment → Destination visit intention	0.309 ***	0.027	Supported
H7: Perceived immersion → Destination visit intention	0.138 ***	0.028	Supported

Notes: *** Significant at a level less than (0.001).

Further, the vividness of Web AR demonstrates a strong positive effect on perceived ease of use ($\beta = 0.456$, $p < 0.001$), perceived usefulness ($\beta = 0.363$, $p < 0.001$) and perceived certainty ($\beta = 0.393$, $p < 0.001$), supporting H2a–H2c, consistent with previous studies. AR vividness positively affects perceived ease of use [8,46,58,59] and perceived usefulness [46,59]. Vividness negatively affects perceived uncertainty [54]. When the destination is clearly displayed, tourists will perceive that the whole augmented reality experience is easy to use and they are able to collect information about the product/service in a more effective way [46]. Additionally, the high vividness of the destination enables tourists to mentally visualize and experience the tourism destination prior to actually visiting it, which enhances the tourists' confidence in their destination selection process. Vividness positively affects perceived enjoyment (0.368, $p < 0.001$) and perceived immersion ($\beta = 0.302$, $p < 0.001$), supporting H2d and H2e; these results are in line with prior studies [9,56]. Perceived enjoyment might be aroused when users experience an advanced visualization of a specific destination. Moreover, a high quality of the destination presented can blur the boundaries between the digital and the physical environment and elevate one's perceived immersion.

Augmented reality allows the creation of unique experiences and therefore plays a paramount role in the formation of tourists' behavioral intentions. The following hypotheses: H3: perceived ease of use ($\beta = 0.212$, $p < 0.001$), H4: perceived usefulness ($\beta = 0.305$, $p < 0.001$), H5: perceived certainty ($\beta = 0.233$, $p < 0.001$), H6: perceived enjoyment ($\beta = 0.309$, $p < 0.001$) and H7: perceived immersion ($\beta = 0.138$, $p < 0.001$) were posited to be positively influence destination visit intention, supporting H3–H7. These results agreed with a prior study supporting H3, H4 and H6 [67]; similarly, a previous study supported H5 [54]. Additionally, former studies supported H7 [13,69,70]. Noteworthy, this study revealed a significant indirect effect of interactivity and vividness on destination visit

intention, mediated by tourists' organism. Specifically, interactivity and vividness had an indirect effect on destination visit intention through tourists' organism ($\beta = 0.388$, $p < 0.05$) and ($\beta = 0.454$, $p < 0.05$), respectively, by using the possible sampling method for the (200) number of bootstrap samples. This highlights the crucial role of interactivity and vividness of Web AR in enhancing tourists' destination visit intentions through tourists' organism in terms of perceived ease of use, perceived usefulness, perceived certainty, perceived enjoyment and perceived immersion as mediating variables. Figure 2 depicts the structural model results. These findings substantiate that those participants who have previewed a destination through Web AR have experienced higher levels of destination visit intention.

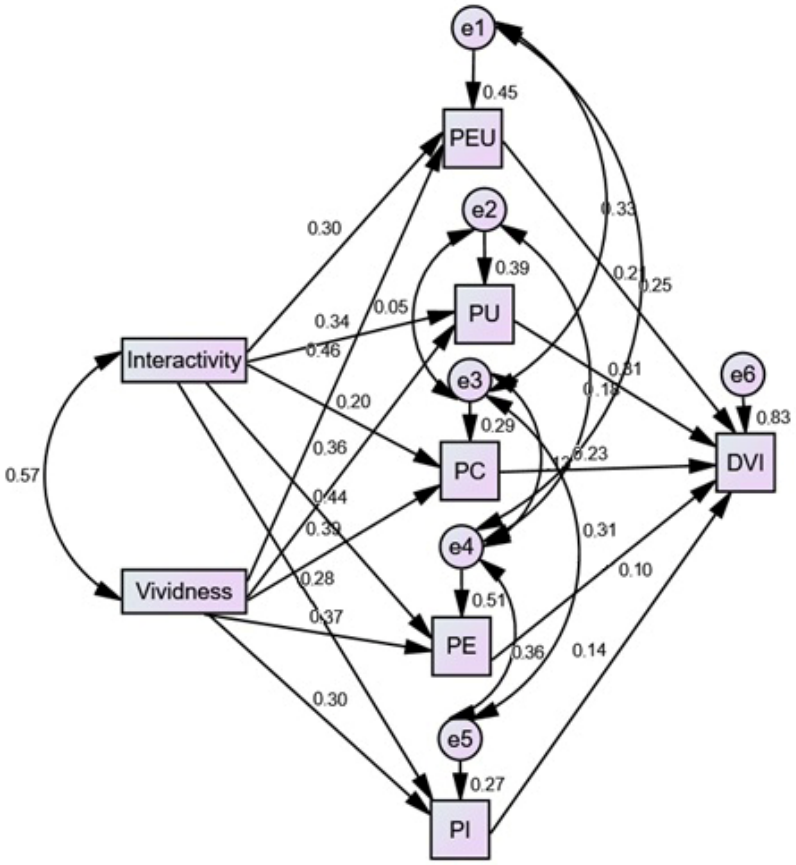


Figure 2. Structural model results.

7. Theoretical Contribution, Practical Implications and Limitations

7.1. Theoretical Contribution

Web AR is a new addition to the marketing sphere in the tourism domain that might inspire tourists and enhance marketing outcomes. There is a gap in the literature regarding the marketing ramifications of augmented reality [84,85]. The novelty of augmented reality in the marketing of tourism destination can captivate potential tourists, developing a sense of exploration. Its adoption in destination marketing enhances the competitive advantages of destinations and therefore attracts tourists [84,86]. Generally, this study makes four contributions. First this paper is anticipated to be one of the first endeavors that contributes to the augmented reality literature by emphasizing its relevance to tourism marketing effectiveness. Measuring tourism marketing effectiveness on a destination level expands beyond just the actual visits to include other psychological outcomes, including visit intention [29]. Therefore, it can be concluded that marketers should not neglect tourists' underlying psychological dimensions, such as visit intention, which are considered a good predictor of people's behavior [87]. Such psychological dimensions can aid marketers in

evaluating the expenditure impact of tourism marketing. The results of this study illustrate that the use of an innovative tool such as Web AR in destination marketing will provide significant benefits such as enhancing tourism marketing effectiveness. In particular, the adoption of augmented reality technology strengthens the tourists' intentions to visit a certain destination.

Second, this study offers fertile ground for theoretical inquiries, particularly in understanding the role of Web AR in enhancing tourism marketing strategies. Tourists can simple "tap and experience" the destination instantly without downloading any applications, emphasizing its accessibility. Responding to a previous study that elaborated on users facing difficulties while installing the augmented reality application [10], this study utilized the Web AR, which paves the way for users to effortlessly access information in a simple and easy way [18]. No prior research has explored the significant impact of the adoption of Web AR in destination marketing.

Finally, the present paper spotlights a plethora of different needs after a comprehensive review of the literature on augmented reality: first the need for more theoretical foundations that bridge the immersive experiences with the tourists' behavioral intention [51,88], second the need for integrated theories to explain tourists' behavior [9] and the need for the integration of the S-O-R framework and the technology acceptance model with less explored theories like flow theory [84]. In light of this, this study amplifies the theoretical understanding of how augmented reality technological attributes can influence tourists' destination visit intention by integrating the TAM, SOR and flow theories into an integrated framework.

7.2. Practical Implications

Currently, with the intense competition between multiple countries' tourism sectors, the need for destination marketing is essential in order to successfully compete. Tourism, as an intangible consumer product, poses challenges, especially to destination marketers who seek to increase confidence in prospective travelers toward a particular destination. Thus, innovative technology like Web AR can become a vital tool in influencing tourists' destination visit intention and give tourists the opportunity to trial the destination before visiting it physically, consequently taking part in the sustainable economic development of destinations. Therefore, the findings of this study yield new practical implications for DMOs to improve tourism marketing effectiveness through the implementation of Web AR in their businesses.

First, interactivity and vividness have impacts on tourists' perceived ease of use, perceive usefulness, perceived certainty, perceived enjoyment and perceived immersion. Therefore, it is pivotal for DMOs to improve the construction of interactivity and vividness in the Web AR experience. To enhance the vividness of the Web AR experience, DMOs can increase the augmented reality experience's depth through high resolution and vibrant representation of the previewed destination, alongside increasing the breadth through exposing users to other sensory dimensions like soundtracks. Additionally, DMOs can improve the interactivity of Web AR by increasing users' ability to control the displayed destination through more interactive features.

Second, our study demonstrates that tourists' perceived ease of use, perceive usefulness, perceived certainty, perceived enjoyment and perceived immersion play vital roles in translating the utilization of Web AR into the tourists' destination visit intention. Concerning this, Web AR should be an integral factor in tourism marketing strategies to promote destinations. Hence, this study suggests that DMOs should focus on creating an augmented reality experience that is easy to use and brings efficiency, enjoyment and state of immersion to people, thus leading to a greater travel intention. Furthermore,

DMOs can employ augmented reality to create interactive and immersive experiences that guide tourists toward responsible tourism behavior. In this way, Web AR can contribute to sustainable tourism planning.

To achieve a pervasive augmented reality experience, the Web AR is most appropriate, thanks to its lightweight and cross-platform capability [89]. In other words, DMOs should invest in augmented reality technology where individuals are able obtain the information they need quickly and with the least effort. Hence, users become more engaged with the destination and have a greater intention to actually visit it, thereby leading to the sustainable development of a destination. Accordingly, tourism stakeholders can leverage AR as a marketing tool by emphasizing its unlimited potential in fulfilling the tourism sector's need for interactive and entertaining services [90]. This study indicates that investing in such technology will take the tourism sector to a new level.

7.3. Limitations and Future Research Directions

This study provides valuable insights into augmented reality tourism and destination visit intention; however, a few limitations could be addressed by future research. The Web AR experience of the "Safaga" sea had limitations due to financial constraints. Future studies can implement a more comprehensive Web AR experience to further validate the proposed model. This study examines the impact of augmented reality stimuli (interactivity and vividness) on tourists' destination visit intention through tourists' internal states (perceived ease of use, perceive usefulness, perceived certainty, perceived enjoyment and perceived immersion). Future studies can test other interesting variables on the current conceptual model. New research could build upon the quantitative findings of this study by employing qualitative measures to provide in-depth insights into how Web AR attributes enhance tourism marketing effectiveness and influence the tourist' destination visit intention. It seems to be of remarkable value that future researchers create an experiment to compare the behavior of individuals who were exposed to augmented reality stimuli with that of individuals who were not. This experiment will provide a proper evaluation about the effectiveness of the use of augmented reality in destination marketing. Moreover, the AVE of the interactivity construct is below the threshold, suggesting a need for scale refinement in future studies. Finally, the findings represent a conceptual overlap between some constructs, and future researchers are encouraged to refine the measurement items to support discriminant validity.

Author Contributions: Conceptualization, A.A.; formal analysis, A.A.; methodology, A.A.; supervision, W.K.; writing—original draft, A.A.; writing—review and editing, W.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Dataset is available from the authors upon reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

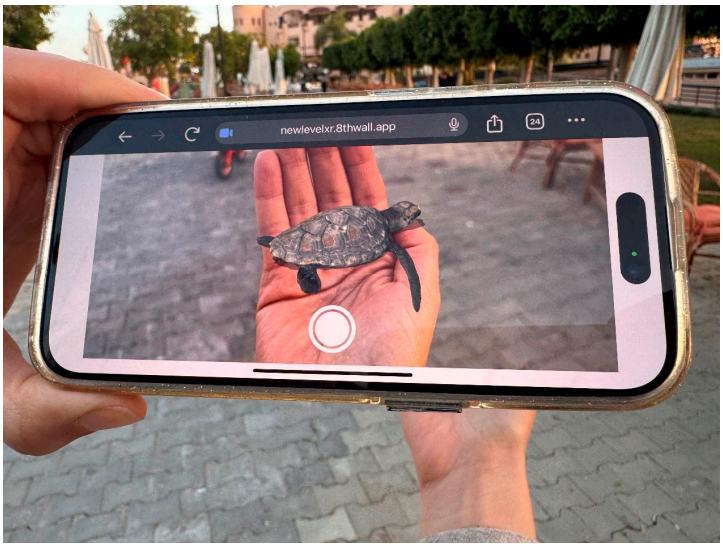


Figure A1. Sea turtle captured within an AR context.

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