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Destiny – A Campus Virtual Tour

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***Abstract*—The challenge experienced by users in navigating complex interior facilities is addressed by the Virtual Tour and Indoor Navigation System using QR Scanner in this research paper. Traditional navigation methods, such as maps and signals, can be difficult to comprehend and frequently give insufficient information about the surroundings. The Virtual Tour and Indoor Navigation System of College Premises named as Destiny is a cutting-edge system developed to give students, faculty, and visitors an immersive and interactive exploration of the college campus. To create an extensive and entertaining virtual tour experience, the system makes use of modern technologies such as virtual reality, augmented reality, and QR code scanning. Users can access a detailed map of the campus and navigate through different buildings and amenities, such as lecture rooms, libraries, labs, and sports facilities, using this system. Users can access extra information about each facility, including schedules, resources, and other pertinent data, by scanning QR codes posted at important areas. The system is user-friendly and accessible, allowing users to effortlessly navigate the college grounds and locate the amenities they require.**

***Index Terms*— Introduction, Literature Survey, Problem Statement, Project Design, Conclusion and Reference.**

I. INTRODUCTION

The Virtual Tour and Indoor Navigation System with QR Scanner is a unique system developed to facilitate users' exploration of complicated interior areas. The system employs cutting-edge technologies such as virtual reality, augmented reality, and QR code scanning to create a comprehensive and immersive virtual tour experience, as well as indoor navigation functionality to assist users in navigating complex indoor spaces such as museums, galleries, and public buildings.

There has been an increase in demand for solutions that make it easier for people to navigate complicated interior areas in recent years. Traditional navigation methods, such as maps and signs, can be difficult to grasp, especially in big interior environments, and they sometimes give insufficient information about the surroundings. This might cause users to get confused and frustrated, especially in unfamiliar or busy situations.

Destiny provides an innovative solution to these difficulties by allowing users to explore complicated interior settings in an immersive and engaging manner. Users may get extensive information about their surroundings, including historical background, architectural features, and other pertinent data, by scanning QR codes posted at strategic sites. Indoor navigation capabilities are also included in the system, allowing users to effortlessly travel around complicated interior areas such as museums, galleries, and public buildings.

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Overall, Destiny provides a unique and user-friendly solution to the issues of traversing complicated interior settings, offering users a thorough and immersive exploration experience. This system has a wide range of applications, including college campuses, museums, and other indoor attractions, making it a perfect option for improving the entire visitor and user experience. Virtual tours are a common term used in the media to describe photography-based media. Text, music, and animation are regularly incorporated into virtual tours. As opposed to flat standard shots, virtual tours offer panoramic images that look like the genuine thing. A broad, uninterrupted, or condensed view is represented in a panoramic photograph. Initially, this vision can only be created by a specialist camera. However, much has changed since the development of information and communication technology, notably computers; even programs built on computers have a tendency to be more effective and efficient. The 360 virtual tour offers a full panoramic simulation form to a 360-viewing angle.

A crucial and challenging topic in the study of virtual reality is the virtual tour. A simulation is a virtual tour that uses long-standing computer vision and virtual reality technology. But as of now, the virtual tour is an intriguing research topic that is developing in accordance with the concerns that are currently in play. Virtual tours are quite popular since they never go out of style and can be combined with other fields like artificial intelligence and interaction between humans and computers. It is an online tour. a program that combines photographic technology with information technology to provide interactive, 3D knowledge about the entire universe. It is possible to include space-related facts into this application, which includes both outdoor and indoor spaces.

The app showcases a working prototype of a virtual tour of campus that can find the user and show them the way. The current version of the app shows the virtual tour of Shah & Anchor Kutchhi Engineering College, but in future the same techniques can be used for other facilities such as malls, shops, temples, museums etc. Destiny provides three features which is, Virtual Tour, and Indoor Navigation. The virtual tour will take you on a tour of our whole campus, and depending on which department you choose—we continue to give choices for computer, electrical, information technology, and mechanical—you will be able to see around classrooms, labs, the faculty lounge, and other locations. This application is mostly useful for students who wish to apply to our institution and tour the campus, since you can also visit the canteen, gymkhana, and auditorium.

The programmes are written in Unity 3D, which runs the entire project. Creating a 360-degree virtual campus tour application for the web. The scripts are essential. We utilised the glanced interaction, which takes you to the next position without demanding user input within 5 seconds after utilising the allowed timeframe (the float total timer). This program's output may include a 360-degree dynamic depiction of photographs of buildings and the campus surrounds, giving the viewer the sense that they are truly there.

Indoor navigation system will help users to navigate from source to destination. They are required to scan the QR code which will be present on every floor of the campus. The purpose of this project is to provide students a tour of our entire campus and the opportunity to take a look around. This application is also crucial for malls, hospitals, and construction sites where users can get tours and easily find their specific locations. The prototype, which simulates a college campus, enables users to investigate the premise from any location.

II. Literature Survey

We examined a number of publications that used virtual tours and discussed them below. This can assist one in developing an effective system based on previously suggested or produced systems by giving them a thorough understanding of all the many system types that have been proposed or developed.

Triyanna Widiyaningtyas Didik Dwi Prasetya Aji P Wibawa [1] proposed Adaptive Campus Virtual Tour using Location Based. In this study, they have suggested creating a location-based service-based adaptive campus virtual tour application (LBS). This adaptive function may keep track of a user's position and quickly locate pertinent locations. The creation of panoramic photographs and the integration of location mapping are the two key tasks. To map the closest place inside a campus, they used the k Nearest Neighbour (kNN) technique. This programme also links the user's position with the closest event taking place on campus in order to deliver additional helpful information. The creation of this application is in keeping with the university's vision and aim to offer a wide range of engaging public information. The use of virtual tours can result in more appealing and immersive than standard photographs. The programme can execute, according to the findings of the application test good and no mistakes.

Triyanna Widiyaningtyas Didik Dwi Prasetya Aji P Wibawa [2] talked about Web-based Campus Virtual Tour Application using ORB Image Stitching. In this work, they proposed the creation of a web based 360-degree virtual campus tour information system, with the goal of showcasing the institution's assets in a captivating manner to the general audience. This programme accepts as input a stitched or panoramic image produced by the ORB image stitching method and renders it as a virtual tour. In order to show a 360-degree dynamic building

and campus environment visualization that seems realistic and as though it were in the actual site, this study implements an image stitching technique. Compared to standard images, a virtual tour technique may provide a more beautiful and immersive look.

Xiaohong Wu, Ivan Ka Wai Lai [3] said, their study examines how viewers respond to a 360-degree virtual tour of Dinghu Mountain in China, and how this influences their sense of presence, cognitive and affective image of the destination. The study collected data from 375 individuals who watched the virtual tour. The findings indicate that mental imagery and engagement in response to the video influence the formation of a sense of presence, cognitive image, and affective image of the destination. However, immersion does not significantly affect the affective image. The sense of presence, cognitive image, and affective image developed through the 360-degree virtual tour influence the viewers' feelings towards the destination. This study provides valuable insights for destination marketers on the design of 360-degree virtual tours for target marketing.

Luigi Malomo Francesco Banterle, Paolo Pingi, Francesco Gabellone, Roberto Scopigno [4] they proposed a virtual reality app called Virtual Tour for Apple iOS 8 devices such as smartphones and tablets. The app is designed to enable easy and natural exploration of Cultural Heritage sites that have been captured with 3D scanning technologies or modeled by artists. The app uses modern mobile devices and their embedded sensors to provide a novel approach for exploring virtual sites. The user follows a pre-defined path in the virtual space and can progress on the path by manipulating a slider or walking in the real-world (with the device sensors detecting user's steps). The view is rotated according to the mobile device's rotation. The app focuses on providing mobile access to hidden or inaccessible sites using 3D representation and breaking the usability barrier that often hinders navigation in complex models on top of mobile devices.

Ang Wei Liang, Noorhaniza Wahid, Taufik Gusman [5], in this paper they proposed the development of an augmented reality (AR) application, called AR-UTHM Tour, to create a virtual tour of University Tun Hussein Onn Malaysia (UTHM) using markerless AR technology. The application enables users to visualize 3D models of UTHM buildings and facilities by pointing their mobile camera at any flat surface. The study conducted a user acceptance test on 30 UTHM students using the Technology Acceptance Model (TAM), and more than 50% of the respondents successfully executed the AR session without any error. The results of the test showed that the users are satisfied with the AR-UTHM Tour application, and it can be used as a medium to introduce and promote UTHM virtually. The study also suggests future improvements in detailing the aesthetic of the 3D model.

Sebastian Kasprzak, Andreas Komninos, Peter Barrie [6] proposed Feature based Indoor Navigation using Augmented Reality. They have demonstrated a prototype for augmented reality-based indoor navigation that leverages interior characteristics to pinpoint the user's location and offer directions. They had put the prototype to the test in a model of a real retail mall and discovered that interior environments, particularly those with goals spread over many floors, can benefit from using AR-based navigation.

Wong Joanne, Sanna Taking, Nazrin Isa and Kok Chao [7] they talked about Indoor Navigation and Localisation Application, the goal of this project is to design and create an indoor positioning tracking application system with the best possible features. This is due to this undertaking being focused on designing and the creation of a tracking application for indoor placement system with the best possible qualities. This is due to the usage of the Global Positioning System (GPS) is not recommended owing to signal loss when in contact with building walls, indoors. Based on the use of WIFI, the indoor positioning system There are several access points in both buildings and mobile devices. Based on the use of Wi-Fi, the indoor positioning system There are several access points in both buildings and mobile devices. Keep in mind that this project's primary objective is to sustain both the budget and the least amount of power possible, while finishing the project in the allotted time. The two primary purposes are to provide localization and navigational assistance.

Xin Hui Ng, Woan Ning Lim [8] write about GPS-based navigation technology that is currently widely employed in the majority of commercial navigation applications. This study conducted research and comparisons to discover the best strategies for indoor positioning, pathfinding, and route guiding for an indoor navigation system. This project's goal is to offer a basic and low-cost indoor navigation system. The suggested system detects the user's position using the current built-in sensors present in most mobile devices and incorporates AR technologies to give the user an immersive navigation experience. An indoor navigation mobile application was built and tested as part of this project. The work illustrates the use of Indoor Atlas, which provides indoor location via fusing technology to detect the user's position and compute the path to the destination, and Arcoren, which displays AR guidance based on the computed route.

Prashant Verma Kushal Agrawal Sarasvathi V [9], talked about Navigation systems that are critical for enroute assistance, indoor placement, and so on. As compared to complicated interior environments, outside navigation is still superior. In this research, we focused on developing an indoor navigation application that uses augmented

reality to assist people in navigating complex buildings, as well as developing a cloud platform (Content Management System) from which the administrator of a specific building can modify and manage the navigation path. The AR-based smartphone application was created using the Unity3d framework. Smartphones can run the programme. An augmented reality-based application has been shown to deliver a better interface and experience than traditional 2D maps or paper maps that are posted outside buildings to aid in navigation. Technical assessments were done in a hospital facility to evaluate the notion suggested in the research.

Ryo Nitami, Akimasa Suzuki and Yoshitoshi Murata [10] discuss the development of a smartphone application that utilizes numbering patterns for rooms on a floor to provide indoor navigation on a campus. The system aims to achieve seamless navigation from outdoor to indoor spaces and specifically targets the third stage of navigation, which is indoor room navigation on a floor. The application does not require additional infrastructure, such as maps or pseudo-satellites, which can be costly. The authors investigated the relationships between existing room numbering patterns and floor arrangements in twelve Japanese universities to develop the application. They found that the numbering pattern depends on the building's aspect ratio and size. The authors verified the integrity of the proposed mapping rules and achieved a 90% integrity rate for floor arrangements that match their defined rules, which is sufficient for practical navigation.

On surveying the papers, one would understand that all the application focuses on Adaptive function may keep track of a user's position and quickly locate pertinent locations. To map the closest place inside a campus, they have used the k Nearest Neighbour (in) technique. This programme also links the users position with the closest event taking place in order to deliver additional helpful information. Feature-based Indoor Navigation using Augmented Reality. They have demonstrated a prototype for augmented reality-based indoor navigation. Suggest more research be done on employing augmented reality to give internal navigation directions. The goal of this project is to design and create an indoor positioning tracking application system. The two primary purposes are to provide localization and navigational assistance. Use of the Global Positioning System (GPS) is not recommended owing to signal loss when in contact with building walls, indoors.

A. Comparison from Existing System

TABLE I. COMPARISON FROM EXISTING SYSTEM

Papers / Features	Adaptive Campus	Web Based Campus	Featured Based Indoor Navigation System	Destiny
Day Dream Algorithm	✗	✗	✗	✓
Collaboration of VR and AR	✗	✗	✗	✓
Indoor Navigation System	✗	✗	✓	✓
Platform Independent	✓	✓	✗	✓

B. Limitation of Existing System

- Network Dependency: The methodology proposed by Adaptive Campus Virtual Tour using Location Based [1] & Web-based Campus Virtual Tour Application using ORB Image Stitching [2] require a stable internet connection, which can be a limitation in areas with poor connectivity or limited access to the internet.
- Lack of Indoor Navigation: Some virtual tour applications such as Adaptive Campus Virtual Tour using Location Based [1] & Web-based Campus Virtual Tour Application using ORB Image Stitching [2] may lack indoor navigation functionality, limiting their usefulness in navigating complex indoor environments such as multi-story buildings or large campuses.
- Computational Requirements: Web-based Campus Virtual Tour Application using ORB Image Stitching [2] requires image stitching or augmented reality technologies used in virtual tour applications may require high computational power, making them less suitable for low-end devices or devices with limited processing capabilities.
- Limited Generalizability: Some research papers such as Identifying the response factors in the formation of a sense of presence and a destination image from a 360-degree virtual tour [3] & Virtual

campus tour application through markerless augmented reality approach [5] focus on specific locations or universities, limiting their generalizability to other educational institutions or settings.

- Small Sample Sizes: Research paper Virtual campus tour application through markerless augmented reality approach [5] conduct user acceptance tests or evaluations may have small sample sizes, which may affect the overall validity and reliability of the results.
- Design and User Experience: Adaptive Campus Virtual Tour using Location Based [1] may lack the ease of use, intuitive interfaces, or well-established user experiences that can impact user satisfaction and adoption.
- Specific Technologies: Ideas proposed by Virtual campus tour application through markerless augmented reality approach [5], Feature-based indoor navigation using augmented reality [6],Indoor navigation and localization application system [7],Design of a mobile augmented reality-based indoor navigation system [8],Indoor navigation using augmented reality [9] and Development of a pedestrian navigation system without additional infrastructures [10] may rely on specific technologies or infrastructure, such as markers, GPS, or WIFI access points, which may not be universally available or reliable in all environments.

III. Problem Statement

A. Problem Statement

The Virtual Tour and Indoor Navigation System with QR Scanner addresses the difficulties that users have in traversing complex interior environments such as museums, galleries, and public buildings. Conventional navigation methods, such as maps and signage, can be difficult to comprehend and frequently give insufficient information about the surroundings. Moreover, people may have difficulty locating certain amenities or displays inside big indoor venues.

Furthermore, when the number of visitors to college premises grows, it becomes more difficult for students and guests to navigate the campus properly, resulting in confusion and irritation. It is also critical to make visitors aware of the different resources that are accessible to them, including as lecture halls, libraries, and sports facilities.

As a result, Destiny attempts to solve these difficulties by offering users an immersive and engaging method to traverse complicated interior areas, making it simpler for users to explore the campus or attractions and locate the resources they require.

B. Objectives

- The primary objective of any indoor navigation system is to guide users through a physical space, such as a building or a store, with accuracy and precision. The system should be able to identify the user's current location and provide turn-by-turn directions to their desired destination.
- The system should be designed to effectively use QR codes as location markers within the indoor environment. This includes scanning and recognizing QR codes, decoding their information, and associating them with specific locations within the space.
- The system should be designed with a user-friendly interface that is easy to understand and navigate. The user interface should provide clear instructions, easy-to-read maps, and any necessary contextual information to help users navigate the indoor space.

C. Scope

Destiny has a wide range of applications, including college campuses, museums, galleries, and public buildings. The system can give an efficient and effective means for students, employees, and visitors to travel about the campus and identify specific amenities, such as lecture halls, libraries, and sports facilities, on college grounds. Furthermore, the system may give guests an immersive and interactive approach to learn about the college's history, architecture, and other pertinent facts, increasing the entire tourist experience.

The technology can provide an interesting and dynamic approach for visitors to examine exhibits and navigate around complicated interior settings like museums, galleries, and public buildings. Visitors may receive extensive information on the displays, including historical context, context, and other pertinent facts, by scanning QR codes placed at strategic points, boosting their knowledge and appreciation of the exhibits.

Overall, the Virtual Tour and Indoor Navigation System with QR Scanner has a wide range of applications, with possible uses in a variety of interior locations. The system can improve the entire user experience, making it appropriate for usage in a variety of scenarios and circumstances. Furthermore, the system may be tailored to

match the individual requirements of various interior locations, making it a versatile and adaptable solution for indoor navigation and virtual tours.

IV. PROJECT DESIGN

A. Algorithm and Process Design System Block Diagram

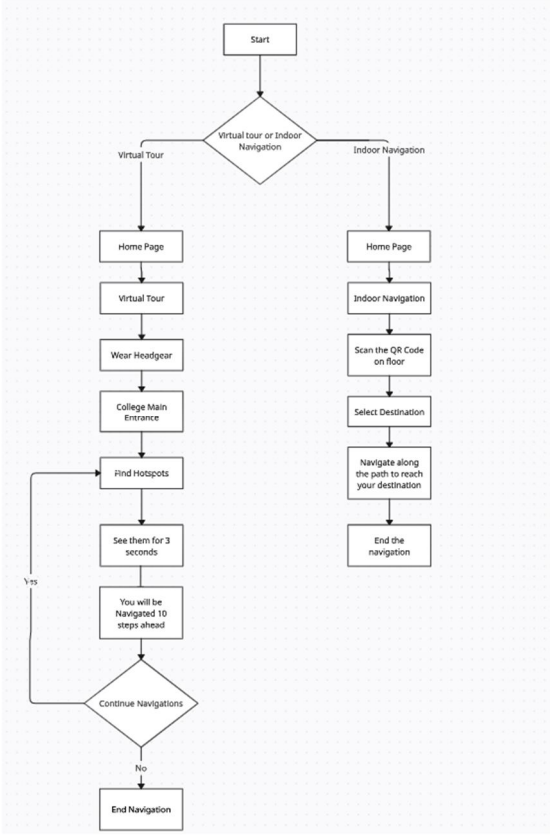

Fig 4.1 Project Block Diagram

Destiny is a mobile application that integrates both virtual tour and indoor navigation functionalities. Users are given the option to choose which feature they want to utilize. If a user selects the virtual tour feature, they will be required to wear a VR headset for an immersive experience. Upon starting the app, the user will be placed at the main entrance of the premises and can explore the area. To move forward, the user must locate and interact with hotspots. Interacting with a hotspot for 3 seconds will move the user 10 steps ahead. The user must continue to find and interact with hotspots to proceed with the tour, or they can choose to end the tour.
If a user chooses to use the indoor navigation feature, they must scan the QR code located at the entrance of the premises. The QR code will serve as the starting point of their navigation. The user must enter their desired destination, and the application will display the path in the form of arrows or lines. By following the arrows in real-time, the user will be guided to their destination.

B. Methodology of Virtual Tour

Click 360 Photos of the vicinity: To create a virtual tour of a vicinity, the first step is to capture high-quality 360-degree images of the premises. This requires the use of specialized equipment such as a 360-degree camera, in this case we have used Google AR Camera. The images should be captured from multiple angles to ensure complete coverage of the environment.
Creating 3D Sphere: After taking and processing 360-degree photos of the surrounding area, the images are added to a 3D sphere in inside-outside format, which is built in Unity 3D. This involves wrapping the images around a virtual sphere, with the inside of the sphere representing the environment.
Adding Hotspots: Hotspots are added to 360-degree photos to increase the interactivity of a virtual tour, allowing viewers to travel to the next location by clicking or pressing on them. Hotspots are clickable places

within a picture that allow viewers to explore different regions of the surrounding environment. Hotspots are used to combine all of the photographs for producing a virtual tour, in addition to offering navigation choices. Users may travel effortlessly across the world and explore it in a natural and intuitive way by connecting the photos through hotspots.

Implementing Virtual Tour Navigation:

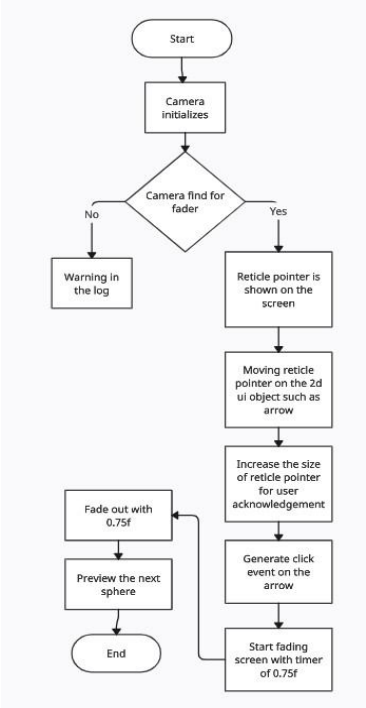

Fig No. 4.5 Flowchart of Virtual Tour

The tour will begin at the college's entrance; to navigate, users must locate the hotspot, which is shaped like an arrow. Users can move or end the tour by clicking on the arrow or hotspot.
In the backend the first step is that, camera is initialized and then it finds the fader, if it can find the fader reticule pointer is shown on the screen or else a warning is show in the log. The reticule pointer is used to find the hotspot which can be in any form of 2d UI, like in this case it is in the form of an arrow. Once the pointer finds the hotspot it sizes increases for user acknowledgement, when clicked an event is generated. The generated event helps us to navigate from one place to another. Basically, the screen starts to fade with the timer of 0.75f and fade out with the same time. This gives the user a feeling of moving forward or backward in the premises.

C. Methodology of Indoor Navigation

Creating Maps: To create an indoor navigation system, the first step is often to create a map of the indoor environment. In this case, the team used Adobe Illustrator to create a 2D map from the blueprint of the vicinity.
Creating 3D Model: After the 2D map of the indoor environment is created in Adobe Illustrator, it can be imported into Unity 3D to create a 3D model of the floor. This involves using the 2D map as a blueprint to build a 3D representation of the indoor environment.
Adding Targets: The next step in building an indoor navigation system is to add destination nodes or targets. These nodes serve as the endpoints of the navigation system, and are typically placed at important locations such as entrances, exits, and points of interest.
Creating a Starting Points: To further enhance the indoor navigation system, the team has added QR codes at the entrance of the floor. These codes can be scanned by users using their smartphones or other mobile devices, and allow users to quickly select their destination and receive navigation instructions.
Creating UI: The indoor navigation system includes a user interface (UI) that enables users to scan QR codes and select their destination. The UI includes a camera function that enables users to scan the QR code using their mobile device's camera. Once the code is scanned, the system displays a list of destinations, along with any relevant information such as room numbers.

Implementing Indoor Navigation

Fig No. 4.10 Flowchart of Indoor Navigation

Indoor Navigation system is the final feature of Destiny. It is an application of augmented reality. To access the indoor navigation system users must be present in the vicinity. Since it works in the real world.
Initially a 3D model is created of the vicinity, the floor and the walls are needed to create, the measurement must be accurate to the real world or else the indoor navigation system will not give the right result. Once the 3D floor is created the AI navigation tool is used to map the entire floor.
Users must scan the QR code which is present in every floor, once the QR code is verified the system asks the user to enter the destination. The system finds the shortest path using AI navigation and then shows the path to the user. Users can follow the path to reach their destination.

V. CONCLUSIONS

Destiny - A campus virtual tour project offers a superior solution compared to existing projects in the field. It combines virtual tour and indoor navigation functionalities into a single mobile application, providing users with a comprehensive and immersive experience of exploring campus environments. Destiny's versatility allows users to choose between virtual tours and indoor navigation based on their preferences and needs. The virtual tour feature utilizes 360-degree photos and interactive hotspots, while the indoor navigation feature guides users in real-time through QR code scanning and accurate directions.
The project excels in terms of user experience, offering immersive VR-based virtual tours and intuitive interfaces. It also addresses the limitation of network dependency by providing offline functionality, making it suitable for areas with poor connectivity. Destiny's methodology ensures scalability and adaptability to different educational institutions by using industry-standard tools like Unity 3D and Adobe Illustrator. Its generalizability sets it apart from projects that focus on specific locations or universities.

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