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Enhancing Travel Experiences through a Virtual Tourist Guide Application

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ABSTRACT: The rapid advancement of technology has transformed the way we travel and explore new destinations. This research paper explores the transformative potential of a comprehensive virtual tourist guide application designed to enhance travel experiences. Traditional solutions like offline guides and booklets for tourists are quickly becoming outdated in the face of smartphone advancements and real-time data availability. By leveraging advanced technologies such as image recognition and location-based services, this application aims to revolutionize the way individuals plan trips, explore landmarks, and engage with tourist attractions. The virtual tourist guide application offers features such as landmark detection using camera images, location-based identification, trip creation, and user-generated content integration. By empowering travelers with personalized recommendations, seamless itinerary planning, and the ability to connect with local experts, this application seeks to redefine the way we navigate and experience the world.

KEYWORDS: Tourism; Technology; Mobile; Guide; Landmark;

I. INTRODUCTION

In the age of technology, the way we travel and explore new destinations has been greatly transformed. With the ubiquity of smartphones and the power of mobile applications, the virtual tourist guide application is an innovative tool to assist travelers in navigating unfamiliar territories and discovering the hidden gems of a city or region.

Traditional solutions such as offline guides, booklets, and brochures have long been the go-to resources for tourists seeking information about landmarks, attractions, hotels, and restaurants. However, the limitations of these conventional methods have become increasingly evident in recent years. With rapid advancements in technology, offline guides and booklets are quickly becoming outdated and inefficient for several reasons.

Firstly, the information contained within printed guides is static and often limited in scope. They provide a general overview of popular tourist attractions but lack real-time updates, user-generated content, and personalized recommendations. As a result, tourists may miss out on lesser-known but equally captivating destinations that are not covered in these traditional resources.

Secondly, offline guides and booklets are constrained by their physical nature. They require space, can be bulky to carry around, and are prone to wear and tear. Additionally, the process of updating and reprinting these materials to reflect changes in attractions, amenities, or local regulations can be time-consuming and costly.

Moreover, the dynamic and interactive nature of the virtual tourist guide application presents a multitude of advantages over their traditional counterparts. These modern applications leverage the power of location-based services, augmented reality, and user-generated content to provide users with real-time information, personalized recommendations, and a rich multimedia experience. Through features like landmark detection using camera images and location-based search, users can effortlessly identify and learn about their surroundings, fostering a more immersive and engaging travel experience.

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Furthermore, the application empowers users to create customized trips and itineraries, helping them optimize their time and make the most of their visit. By incorporating features for adding pictures, reviews, and ratings, these applications facilitate the sharing of experiences and recommendations among users, fostering a vibrant community-driven ecosystem.

II. PROBLEM STATEMENT

Traditional tourist information solutions like offline guides and booklets are outdated, lacking real-time updates and personalized recommendations. They are inconvenient to carry and fail to provide an immersive experience. A need exists for modern virtual tourist guide applications that leverage technology to offer up-to-date information, personalized recommendations, and an engaging travel experience.

NEED

➢ Increasing number of tourists coming from various parts of the world who speak different languages

➢ Lack of interactive system for providing information about tourist places

➢ Loss of history & importance of landmarks because of unawareness regarding the place

➢ Issues and limitations of traditional, paper-based guiding systems

➢ Trip Planning and Itinerary Creation

➢ Features like Real-time information, User-Generated Content, Personalized recommendations and Enhanced Accessibility

III. RELATED WORK

In the previous publication, related to the considered topic, the authors provided the description of related work in the area of tourist guides. There are many state-of-the-art papers that evaluate different mobile tourist guides. At the present the following developed systems have been considered

Paper Title	Author & Year	Methodology	Image Identification method	Proposed Solution Summary
Virtual Tourist Guide	Harini B, Ashmitha K, Deepan Raj K R, Janani S R Published Date - March 2021	Landmark Information is displayed with the help of Augmented Reality videos and voice overs.	-	An Augmented Reality tour that makes use of location-aware technology. It scans the tourist place images and conveys the information and history using voice over and video using AR.

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Android Mobile Based Tour Guide System using Augmented Reality	Akil. H. Sayyad , Santosh. A. Shinde Published Date - July 2016	Using Symmetric and combinatorial matching Algorithm, key points in Query Image are computed. The image that has highest matching score is considered and Landmark information is retrieved from the labeled dataset.	BRISK & FREAK	Binary Robust Invariant Scalable Key-points (BRISK)and Fast Retina Key-points (FREAK), two state of the art binary feature descriptors, are connected for recognizing/tracking target images with low computational force and high level of accuracy.
Smart Booklet: Tour Guide System with Mobile Augmented Reality	Heeseung Choi, Gyu Chul Han, and Ig-Jae Kim Published Date - January 2014	Symmetric and combinatorial matching is applied to find nearest neighbors based on key points. Image with the highest score is retrieved. For 3D video tracking, tracking-by-detection approach is used on a per frame basis.	BRISK & FREAK	A mobile tour guide system based on AR for tourists usable anywhere if they possess an off-line tour booklet. 3D virtual models are rendered on the images in the off-line booklet.
A Mobile Application based on Global Positioning System and Object Recognition Towards a DIgital Tourist Guide	WadiiBoulila, Anmar Abuhamdah, Maha Driss, Slim Kammoun, Slim Kammoun Published Date - April 2014	The image is processed in on device DL model provided by Firebase Vision. The result will be an array that contains place names and confidence of each place.	Firebase ML kit SDK, GPS - Haversine Formula	An application that provides 3 ways of identifying and retrieving landmarks: Image based, GPS Location Based and Manual search for retrieving list of monuments for pilgrims.

IV. FEATURES

➢User-friendly android application.

➢Multiple modules are combined into one application.

➢Portable, as it will be available in android phones.

➢Provides reusability and scalability.

➢Multiple language support

➢Lightweight, works on all smartphones

➢Search feature for finding landmarks of choice

➢Trip Planning feature

➢Voice command detection for visually impaired people

➢Tour guide option

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➢Landmark Information can be downloaded for later use, in case of no network connectivity

➢Reviews for reporting false or incorrect information about a landmark

V. METHODOLOGY

The application uses technologies like Machine Learning(ML) and Image Processing algorithm to get the place details like name and location .

-Google's Places [13] and Vision APIs [12] are used to further identify the place based on geo-coordinates and provide appropriate details.

-Based on the location[13], a list of related tourist places around the vicinity is shown to the user.

-A blog-like system for allowing the users to add/edit pictures along with reviews for sharing their thoughts about a tourist place is also implemented.

-Trip planning feature allows the user to save the places they would like to visit in a collection, and see all of the places, along with a map, for better route and itinerary planning.

-Voice detection allows the user's to execute specific actions such as detecting location, identifying landmarks using voice commands. This is specially useful for visually impaired people.

-Users can also register themselves as tour guide for a particular tourist place. Other users can see such guides and call them if needed.

A middleware cache will also be implemented. Landmark information retrieved from Google Vision API will be stored in a server database. Subsequent requests from nearby coordinates can be answered with this information without having to call Google Vision API. This will further reduce the response times as well as the costs required for operation.

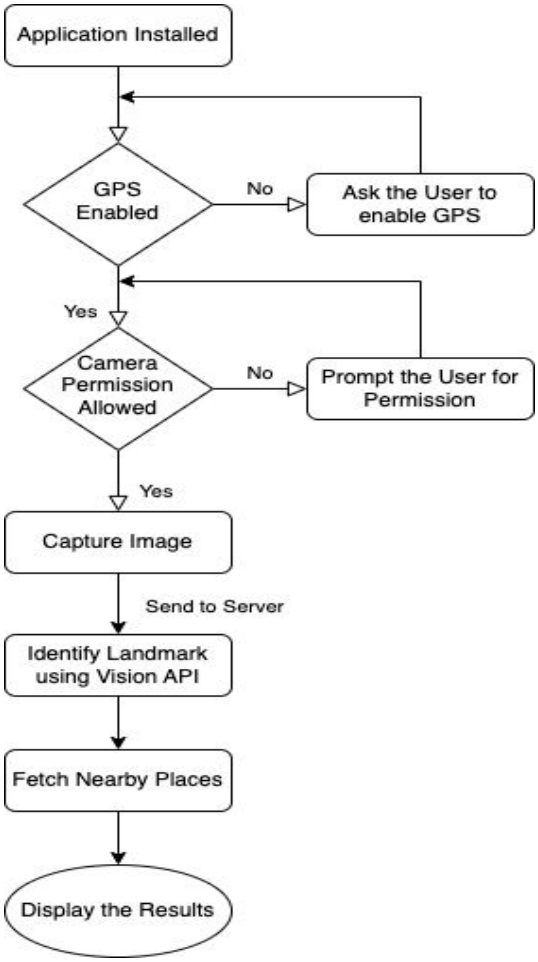

Fig 4.1: Flow chart

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VI. SYSTEM IMPLEMENTATION

SYSTEM ARCHITECTURE

There are currently 4.78 billion mobile phone users worldwide, of which 3.5 billion use smartphones. Users can now easily purchase a smartphone with a built-in digital camera and internet connectivity for a low price. Based on this, the suggested approach will enable end users to utilize their phones as equipment to identify landmarks and get information about them. The consumer can photograph a tourist place, in order to discover relevant information. These images will be processed and verified by the server after being included in a request. After that, the end-user will receive the results along with a list of nearby places that might be of interest to the user.

An overall architecture of this solution is shown in figure below.

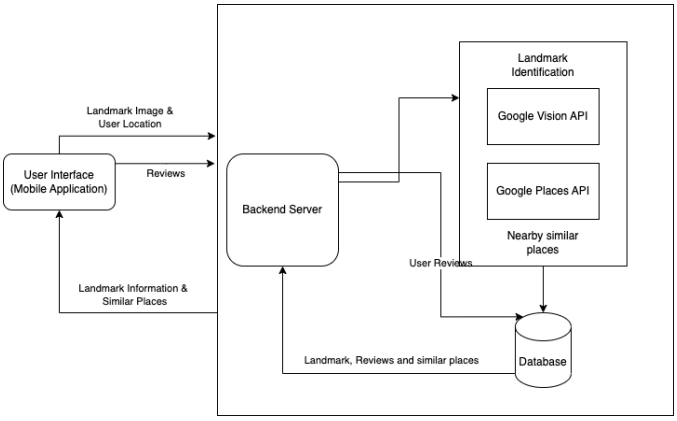

Fig 5.1: System Architecture Diagram

MODULES

A. MOBILE APPLICATION

The mobile application will be the user facing part of the system. It will include a screen for the user to capture an image of a landmark. After clicking a picture, it will be sent to the server. The mobile application will also make use of GPS location to further provide a list of tourist attractions around the user's location. The user can then browse through the list and get any information about them. Navigational functionality will also be a part of the system so that user's can identify the distance and potential roads, routes to the destination place.

React Native, which is a framework for developing cross platform mobile applications, is used on the client side application. The framework is robust despite being easy to develop in. It is based on the React.js framework for the Web. Using React Native, we can code once and develop an application for both iOS and Android operating systems.

B. SERVER

The server will handle all the complex processing and data storage required for the system. Requests from the mobile application will be first handled by the server. These requests will include images of the landmark along with GPS Coordinates. The server will forward the data to Google Vision API & Google Places API. The results will be stored in a database for faster access in consecutive requests. Reviews and suggestions about landmark information will also be stored in the database through the server.

The server will be connected to the mobile application over a REST API. The technologies used for development will consist of Javascript, Express.js, Node.js.

C. IDENTIFICATION

The Google Vision API takes an Image as an input and can identify objects[12] in it based on provided criteria. Landmarks and monuments can be identified using that, which will be returned to the server, which will store them first in the database. It will also retrieve any reviews for the tourist place and then in turn send the information back to the client application.

The results from popular tourist places will be cached to send the data faster to the users without having to run the Google Vision identification pipeline again. For eg. For multiple user requests that are coming from very specific GPS coordinates around a small region, we can safely assume they all are at a single tourist location. Thus we can identify

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the tourist place for the first request and cache it in our database. For any consecutive requests coming from that region, we can send the cached data very quickly.

D. SUGGESTIONS MODULE

The Google Places API provides features like Geocoding, Reverse location search, Search related functionality. It will provide the ability to search any tourist place and return its GPS Location, along with the navigational data. This data will be parsed by the mobile application and displayed appropriately. The Google Places API also allows retrieving a list of items based on a given filter around a specific coordinate. We will provide the user's location as the origin and retrieve a list of tourist places around it. We also provide the best activities for the user to explore ,nearby hotels where users can stay and food which the user should try.

Using the Reverse Geocoding functionality, more accurate identification of a landmark can be done. We can use the user's current location to pinpoint the exact place along with using the Landmark identification from the image. This will provide more accurate identification to the user.

E. VOICE DETECTION MODULE

The mobile application uses a built-in Speech-To-Text system on android and iOS to recognize speech. The recorded voice is searched from the list of commands which are 'Detect location', 'identify landmark' to match with the user's speech input words. It will throw an error if no command is matched with the user input words and will execute further if the command is matched with the user speech. The application uses built-in 'Text-To-Speech' API in Android and iOS to convert the result into speech and play it to the user.

VII. RESULTS

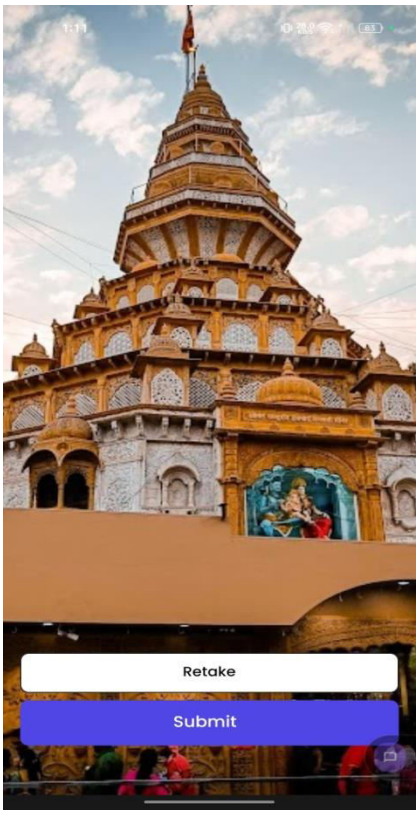

Fig 6.1: Landmark capture screen

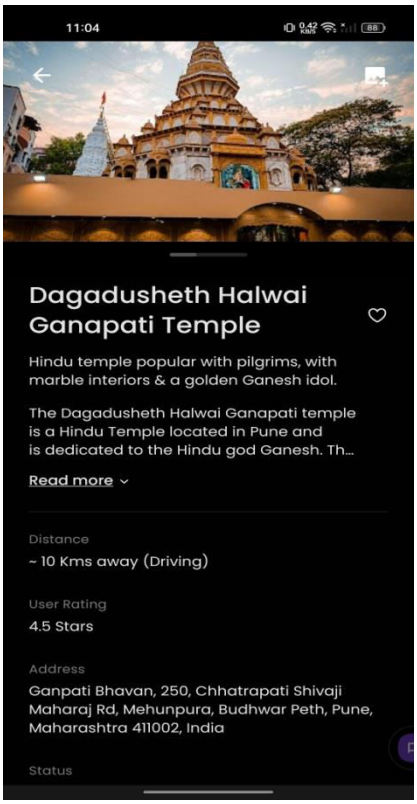

Fig 7.1: Information about identified landmark

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A. LANDMARK IDENTIFICATION SCREEN

The user can use their camera to aim at a tourist attraction and the application can identify the landmark. Once the user captures an image, the image along with the user's GPS coordinates will be sent to the server for landmark identification. After the identification process is completed, the user will get a response with the details.

B. INFORMATION ABOUT LANDMARK

The user can see information related to the landmark. The location of the landmark will also be available to the user along with a button to get directions for navigation.

Users can view other's reviews and can add their own reviews and elaborate their experience after visiting the place which can help other tourists who might plan to visit the place based on the review.

Lastly, the user will have a list of related landmarks or tourist attractions that are nearby the user's current location. The user can scroll through these and plan their trip accordingly.

VIII. PERFORMANCE AND EVALUATION

The performance of Google Vision API varies by the image provided. Google Vision API provides a confidence score for each landmark detection, which can help assess the confidence level of the identification. The average confidence score was observed to be around 80-85%. Blurry or zoomed in typically result in less accurate results in Google Vision API.

IX. CONCLUSION

The major issue with traditional tourist-based guide systems is that they present static photo-copied images with limited information, so they have limitations in intelligent representation and precise navigation. Secondly, the information that is present is available in the regional language of that particular area which can not be understood by the tourists visiting the landmark, and most of the time the in-person guide is also not available at every landmark to guide and inform about the place to the visiting tourists.

This Mobile Application "VIRTUAL TOURIST GUIDE", overcomes these challenges by allowing the user to identify and access information about tourist places in the language they understand, just by capturing an image. With this app, one gets to know the history of a place, the intricacies involved in the art or monument, and provide any additional information and opinions about it. Also, the app provides a list of tourist places in the vicinity of the user's current location. Henceforth enhancing the overall traveling experience of the tourist.

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