

Travel Buddy – Augmented Reality Travel Guide

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Abstract - Tourism is one of the major roles in Sri Lanka. Many foreigners visit Sri Lanka because it has a huge history of more than 2500 years and various environments with different climates within short distance and beautiful beaches around the country and so many things. Most tourists like to learn about our history and see ancient ruins around Sri Lanka such as Polonnaruwa, Anuradhapura, Sigiriya etc. But most of ancient places do not have proper details about that place. Some places had boards with some details but now those are damaged with the time. Those were very valuable because students, foreign tourists learned or gathered much information from those. Otherwise, they will only know about the name of place without any other information. Tourists like to see climate changes before they plan their trip. Some of the tourists have images of locations but they do not know what the name of the location and information of that location is before they visit to that location. Similarly, travelers like to see hidden places around the world. Now we live in a digital world. So, we can have a digital solution for that using augmented reality. It will be very easy for users because 99.9% of travelers bring a mobile device such as mobile phone, tablet pc with them.

Keywords – Tourism, Sri Lanka, Augmented reality, Mobile Application, Digital

1. INTRODUCTION

After the covid-19 pandemic situation and lockdown period, many people started travelling across the country. Many of them go to the historical places in Sri Lanka but they do not aware about many places and historical value of those places. Also, they will hard find photos of relevant places. Many historical places such as Sigiriya, have damaged statues and those statues have huge ancient value. Most people do not know any information about those statues. Using augmented reality (AR) we can recreate AR image of those statues by using mobile phone. Lot of people have some images of the location but do not know the location name. Using AR, train markers of locations and travelers can view how the weather condition looks like before going to the location is more informative for the travelers. The climate, it can change at any time and mostly local travelers use motor bikes as their transportation method. It will be better if travelers can be aware about the expected climate of that place before they visit the location. If we can suggest them less – attracted places around the desired location and show those places using AR images, it will help them to plan their trip and manage time and expenses well. It will be easy for them if they can create their travel route before they go there. It will be very helpful they can see the location by using Augmented Reality images and also it will be helpful for them if they can see other people's thoughts about the desired destination and view latest updates such as when closing a road due to a maintenance

works or like changes of ticket prices likewise. Also, when they go to the location there can be many damaged statues with the time. They cannot identify those, and they do not aware the value of those. Then it will be better if they can point camera to a statue and identify it, then show information about that and show the AR image of statues original state will help them to gather some unknown information and it will be easy for them than reading damaged information boards. Similarly, that thing will help students for their educational works too. There is no such app for create trip plan with friends, showing statues using AR, display weather conditions using AR, showing hidden places in a travel location, find a location using an image and display weather conditions of that location in single application. This application makes easy for foreigners to plan their vacation on Sri Lanka with bunch of additional information and it will be a new experience for all kind of travelers without any doubt. Augmented Reality and Object Detection technologies were used for the development of the application. In this research we provide all these features in a single application.

2. LITERATURE REVIEW

Many web-based systems and mobile applications have been designed to grow the traveling industry. Those applications are mostly created targeting local and foreign tourists. But among those applications, there are very few applications based on Augmented Reality. Many

companies as well as some developers have tried to give the most valuable features to the travelers through their applications. Most of these popular trip planning apps only have photos and some important details of each tourist place. Then the user of the app will be able to understand about those places only through those photos and the details in it. Also, many applications do not provide accurate weather data for each location. It is difficult for the user to get an idea about the weather only by that data. And from these popular apps, it is not possible to get the data about the locations that were hidden in the past and are currently hidden. Then tourists who are interested in such places will not be able to get details through those apps. Also, users who are interested in knowing how things were in the past, such as broken and destroyed statues, cannot get such details through these apps. The Travel Buddy mobile application is created by enhancing the above-mentioned features and using Augmented Reality technology to increase efficiency. In addition to the general photos and descriptions of the places, the Travel Buddy application has been created in such a way that the user can see the 3D models of those places through augmented reality technology. The user will then be able to gain a broader understanding of the locations they prefer. And Augmented Reality allow users to experience accurate weather forecasts for each location as well as the weather conditions. Also, the Travel Buddy app gives the user the ability to experience the broken and destroyed buildings as they were in the past through Augmented Reality technology. Not only that, this introduced Travel Buddy App also allows users to view places that have been destroyed and hidden in the past through Augmented Reality technology. Previous Researches and their shortcomings are listed in below table.

Year	Title	Shortcomings
2015	Visit a city Personal Travel Guide application	<ul style="list-style-type: none"> User cannot see the weather of unknown locations. User cannot see the nearby places in AR view. No trip planner
2018	Tour Buddy smart travelling application	<ul style="list-style-type: none"> User cannot see the weather of unknown locations. No location categories.
2019	TourGuru	<ul style="list-style-type: none"> User cannot see the nearby places in AR view. User cannot see the AR image of ancient statues.

Table 1 – Previous Researches and their shortcomings

3. PROBLEM DEFINITION

When someone has an image of unknown location as printed material or on another device (Mobile, Tab), but he wants to know about that location for traveling purpose this application has the potential to close that gap. When

someone has an image of unknown location on his/her mobile device, but he wants to know about that location for traveling purpose this application has the potential to close that gap. Some people do not know about locations, and they will not plan the trip according to the place because lack of experience etc. So, they will face many troubles. In this travel buddy app People can View locations in AR and get idea about location before visit there and, they can view details of locations. So that they can plan a trip better using Trip Planner. Most of ancient statues are damaged with the time and human activities. People cannot identify and take idea about those things. This problem will mainly affect to the students and tourists those who wants to know about ancient values of that statues. Some places have information boards, but those things are also damaged because of many reasons. Also, with the pandemic period and fuel shortages in the country they cannot go to the relevant locations and its cost is high. Most people don't know about how current situations in relevant places. Mostly the foreigners those are traveling as couple without any tour agency support. Current situation of places is changing on these days because of dollar rate and the corona pandemic. Plan trip properly by getting idea about locations before visit there: Some people do not know about locations, and they will not plan the trip according to the place because lack of experience etc. So, they will face many troubles. As an example, some locations cannot visit by getting routes from google maps. So, traveler need to know the right road to visit there. Unless they can't find the relevant location or path to there. Sometimes travelers do not have idea about locations and their nearby places, and sometimes they missed the important locations. So, they will face some troubles. In this travel buddy app People can View locations as well as nearby places in AR and get idea about locations and their importance, they can view details of locations and they can know about the distance between locations.

4. METHODOLOGY

a. *Display weather conditions in AR and find a place using an image*

If the user has an image, do not know about the location of that image, our solution provides the image's location and accurate weather data using AR technology. For an example user turns on the camera and aim to the image it will show output as the location name and accurate weather information using 3D models and AR technology as below.

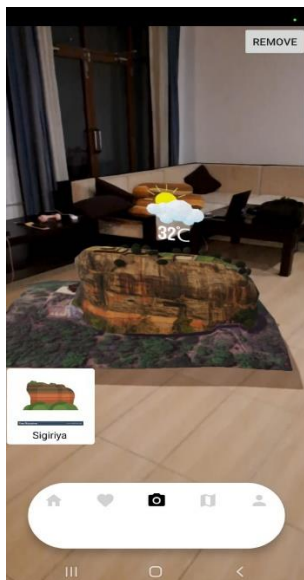


Figure 1 – Identify image's location and display weather

In this component we provide accurate weather data for a location using an API provided by weatherAPI.com. It provides access to weather and geo data via a JSON/XML restful API. It allows developers to create desktop, web and mobile applications using this data very easy [1]. We train markers using Google ARCore to get identified a location. ARCore, also known as Google Play Services for AR, is a software development kit developed by Google that allows for augmented reality applications to be built. ARCore uses three key technologies to integrate virtual content with the real world as seen through the camera of a smartphone or tablet [2]. Six degrees of freedom allows the phone to understand and track its position relative to the world. Environmental understanding allows the phone to detect the size and location of flat horizontal surfaces like the ground or a coffee table. Light estimation allows the phone to estimate the environment's current lighting conditions. When the location identified using the camera, it provides 3D model to show the current weather condition in that location using the AR. Also, detailed weather view provided to see the upcoming days weather details. When comes to the find place uploading an image, we use Vision AI API provide by google [3] to the recognize the image. Then we provide specific location related to that image.

b. View Nearby Places in AR

In this component travelers can view the nearby places in AR model, around the place where they visit. They can hold the camera of the mobile phone to the place they visit, then they can view the most nearby places in Augmented reality (AR) views from where they are. Therefore, google AR Core, cloud anchors and Augmented images were used to implement the system. Google AR Core is a googles platform for building augmented reality experiences using different API s. We used to google AR Core to get identified a nearby locations.[4] Cloud anchor is a special type of anchor that be used to persists AR experience in the real world. We use Cloud anchor to shows the nearby places according to the directions of the location. When the location identified using the camera, it provides AR view of the place where

you are and shows all the nearby places with details and how far it is from the place where you are. We should take the distance between each place, then we used to google distance API for manage the exact distance between the nearby locations. Initially collected location information from The Story of Anuradhapura the book that written by Senani Ponnampereuma [5], Sigiriya and beyond book that written by Neranjana Gunetilleke [6] and Sri Lankan ancient places web sites [7]. Collected all the details like, distance between locations , and historical significant of that places as well as how far it is from where you are.

c. Display tourist spots as augmented reality scenes

In this component, we provide the ability to view tourist spots in Sri Lanka as augmented reality scenes using Google's ARCore and SceneView / sceneform SDK. Here, the camera first identifies a flat surface and then uses ARCore and SceneView / sceneform to render the 3D view required by the user on the identified surface. And we also provide some details related to those tourist spots. The core technical circle of AR, which includes 3D registration, intelligent interaction, and intelligent display technology, is crucial to the advancement of AR. Google's ARCore is a software platform for creating augmented reality (AR) applications. This enables device hardware and cloud software enhancements to bring digital items into the physical environment. Motion capture, environment perception, and perception of light source are the three basic roles. [8]. And SceneView / sceneform makes it straightforward to render realistic 3D scenes in AR and non-AR apps, without having to learn OpenGL. It includes A high-level scene graph API, A realistic physically based renderer provided by Filament, An Android Studio plugin for importing, viewing, and building 3D assets [9].



Figure 2 – Display Locations

d. Identify ancient statues and show AR image to user

In this component users can identify ancient statues and view those statues as Augmented Reality images using mobile phone camera. User can point mobile phone camera into the statue image that user wants to view in

AR and application will identify the statue using image then application will show the relevant AR image for the statue. We use blender software to design 3D models. Blender is the free and open-source 3D creation suite. It supports the entirety of the 3D pipeline—modeling, rigging, animation, simulation, rendering, compositing, and motion tracking, even video editing and game creation [10]. After mobile phone camera pointed to the statue image, application will use Augmented image API to identify the statues details using provided images by user. The Augmented Images APIs in ARCore lets you build AR apps that can detect and augment 2D images in the user's environment, such as posters or product packaging. ARCore uses a computer vision algorithm to extract features from the grayscale information in each image and stores a representation of these features in one or more Augmented Image databases. At runtime, ARCore searches for these features on flat surfaces in the user's environment. This lets ARCore detect these images in the world and estimate their position, orientation, and size if one is not provided. [11]. After identifying the image details, application will identify the surface and it will render 3D models at camera view and display to the user as an AR image. For this process application will use google sceneform API. Sceneform makes it straightforward to render realistic 3D scenes in AR and non-AR apps, without having to learn OpenGL. It includes: A high-level scene graph API. A realistic physically based renderer provided by Filament. An Android Studio plugin for importing, viewing, and building 3D assets.[12]. Then user can view the AR image and details about the relevant statue using mobile phone camera.



Figure 3 – Identify broken statues and preview their 3D model using AR technology

5. CONCLUSION

First problem we face while developing this project is in the newer versions of android studio is not supported the Sceneform dependency. As for that we have to use Android studio version 3.3 to use Sceneform. We use

Sceneform to convert 3D models to sfb format. All the 3D models are in obj format with textures. With Sceneform we can convert those files into single sfb file and we save those files in the Assets folder in the project structure. When we research about how to get the accurate weather information, we found an API from weather.com. we have to pass longitude and latitude of the location to that API and we can get accurate weather data of that location. After we get the weather data, we must save those weather data in variables. We use several images of some locations and save those images in drawable folder in the project structure. We can use those images as markers to identify an unknown location with ARcore dependency. If the image gets identified by the ARcore the 3D model related to that location will anchor on top of the image. Also, we use ARcore text view to show weather condition and location name top of the 3D model. Second function is finding a location using uploaded image. we use VisionAI API provided by google to identify the image. In this API we can identify images such as foods, texts, landmarks etc. We use landmarks for this implementation. If user upload an image using the app it saves into the firebase. And we have to create a server using SpringBoot. Inside the SpringBoot server we must implement the VisioAI API. Also, we use a library called Volley to catch the URL of the uploaded image to the firebase. The caught URL by the Volley goes in to the VisonAI API and the API provide the location name, longitude and latitude. As per that we can use that longitude and latitude for mark it in the map of the application UI and provide the name of the uploaded image's name. Then by using the smartphone camera and AR core to detect a flat surface and then by tapping on it, we can place the desired 3D model on the flat surface. Two rendering techniques are used here. That is, to render the 3D model, the techniques called Model Renderable and View Renderable have been used to render the description labels. Here, when the user creates a new trip plan, a new trip is created under the user in the trip collection in Firebase. After that, you can share the ID related to that trip with your friends and get them to join in planning the trip. Then the locations that are selected one by one on the map will be shown to all friends in real time. The Firebase Realtime database is used for this. In addition, Google Maps API and Places API have been used. Using the mobile phone camera and AR core to detect the location and tap on it, we can view the nearby tourism attraction places around 5km s. Here we used Google AR core, and Magneto meter to place AR models in correct location. And to find out the current location have to access the compass. The Firebase Realtime database is used for this. In addition, Google Maps API and Places API have been used. As the first issue researchers faced where they can find statues. In the initial discussions our team discussed to create this application based on Sigiriya. This component was to identify statues, Researchers was searching for statues in Sigiriya. Then they found that Sigiriya has only few statues and those are in the museum of the Sigiriya, and people are prohibited from taking pictures of those. Then after discussing with the supervisor, Researchers decided to do my part for another statue. Second issue was to train data set to identify images. After referring many video tutorials and reading blog posts researchers have found that data can be trained using python. Also, researchers

found another method as TensorFlow. The features in TensorFlow Lite (TFLite) enable TensorFlow models to be optimized for use on mobile and edge devices.[5] Google created it for internal usage before making it open-sourced. Models can be easily trained using that website. Then I found a big collection of good quality pictures of statues and trained a model using tensorflow website. After implementing it as an android application, it was not so accurate. Then I started to follow unity to create this application. Also converted trained TFLite models to onnx format. It was not working too. Then I found the Google AR Core and found that it has a feature named Augmented images. Then implemented those using Android studio. As per a team we faced another issue. AR Core needs an 3D model type named. sfb. It was hard to find that format 3D models. Then after we found that those models can be converted using google Sceneform. But that project is discontinued and open source now. Then we found that older versions of android studio can work with available versions of sceneform. Then we converted models using google sceneform. After all researchers had to face another issue. Application was getting crashed when my feature is loaded. After few investigations' researchers set a max scale and min scale to the 3D model. It was effective and crashing had reduced. Tried by adding low poly models but didn't saw any improvement. To the second function used the firebase. It has real time database and a database named fire store. we used fire store to store and retrieve data. As future work, we must increase the user friendliness in the UIs of the application, and we have to commercialize the application. In the future we upload that 3D models into firebase to decrease the RAM usage. we hope to make UI/UX more user friendly and mainly to optimize the application to work with low specs mobile device without lags or crashes. And also, to develop review feature to add reactions, follow options, anonymous places adding likewise options to create a traveler's community inside the application. Therefore, we can organize environmental welfare programs and commercialize the application in many ways.

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