

Personal Map Depict: A Navigation Application

Shruti Lodha^{1,*}, Suhani Tiwari¹, Sanjeev Patwa²

Abstract

In our contemporary world, the importance of navigation is burgeoning rapidly. The digital landscape has revolutionized user experience by allowing individuals to effortlessly identify, locate, and map their routes with a mere click. At the heart of this transformative era lies mapping solutions, serving as the natural ingredient on today's web. The significance of navigation has soared to new heights owing to its unparalleled convenience. Recognizing the pivotal role of navigation, businesses must ensure their online presence, as this dynamic tool not only personalizes user experiences but also empowers them to explore and meticulously plan their commutes. Leveraging our comprehensive understanding of Application Programming Interfaces (APIs), we have developed a sophisticated web application using Django, a robust framework. Introducing our innovative creation, Personal Map Depict, a groundbreaking web application, designed to provide a seamless navigation experience for users worldwide. This intuitive platform goes beyond traditional mapping, allowing users to not only navigate effortlessly but also plan intricate commutes with precision. A distinctive feature of our application is its capability to save user addresses, enhancing the overall efficiency and convenience of the navigation process. Our overarching goal with Personal Map Depict is to simplify the navigation experience, ensuring that users can effortlessly reach their destinations every time the need arises. By amalgamating theoretical knowledge into practical solutions, our web application exemplifies the commitment to solving real-life problems and enhancing the day-to-day lives of individuals globally. Welcome to a world where navigation is not just a feature but a personalized, user-centric journey.

Keywords: Navigation, API, Map Depict, Django, Google Maps

INTRODUCTION

In today's world, the crucial and necessary ingredient is navigation. We require navigation in our day-to-day life as we have to locate places, search for the position of some specific address, then get detailed driving directions and commute time, and do a whole bunch of numerous different activities.

*Author for Correspondence

Shruti Lodha

E-mail: shrutilodha21.set@modyuniversity.ac.in

¹Student, Department of Computer Science & Engineering, Mody University of Science & Technology, Sikar, Laxmangarh, Rajasthan, India

²Associate Professor, Department of Computer Science & Engineering, Mody University of Science and Technology, Lakshmangarh, Sikar, Rajasthan, India

Received Date: January 31, 2024

Accepted Date: February 07, 2024

Published Date: April 03, 2024

Citation: Shruti Lodha, Suhani Tiwari, Sanjeev Patwa. Personal Map Depict: A Navigation Application. Journal of Mobile Computing, Communications & Mobile Networks. 2024; 11(1): 7–12p.

Every business ranging from small scale to large scale has a physical location and once you have a location, it can be displayed on a map. Google Maps serves as a web-based mapping service, offering a solution to the challenges of online mapping. The Google Maps API provides a means to leverage the capabilities of Google Maps, allowing developers to integrate it into their applications for the efficient and user-friendly display of data. The interactive features of Google Maps are achieved through the collaborative use of HTML, CSS, and JavaScript. Map tiles, serving as images, are loaded in the background through Ajax calls and then incorporated into an HTML page within a designated <div>. When users navigate the map, the API sends information about updated coordinates

and zoom levels through Ajax calls, resulting in the retrieval of new images. The API itself is composed of JavaScript files containing classes with methods and properties, enabling developers to customize the behaviour of the map within their applications. In our project, Personal Map Depict we have built a web application using Google Maps API in which the user will be able to navigate comfortably between any two waypoints (origin and destination) with proper detailed information on the following:

- Distance Travelled;
- Directions to be followed; and
- Duration from the origin to the destination; every step with distance and time in between from origin to destination.

For this Django web application, we have used six different Google APIs which are Google ReCAPTCHA version 3 to score a form submission. API is used to predict the address and pre-populate addresses, Distance Matrix API is used to calculate the exact distance between geo-points submitted by the user, Directions API for showing directions as the name suggests, Geocoding API for pinpoints to be geocoded and Maps JavaScript API for Ajax calls. We have also used a virtual Env wrapper for creating a separate Python environment for our project [1, 2].

PURPOSE

With an in-depth analysis of many navigation web applications available online, the issues that we faced were that such applications have neglected the importance of building a user-friendly interface which is easy to use and comfortable for the user. Other than this, the applications does not save the user information, due to which, the user needs to enter the credentials on every visit which is an unnecessary and troubling task. After these issues, many web applications are not successful because the users find it difficult to use the application in the first place [3]. The most used navigation applications include Google Maps and Waze. The limitations of such applications are:

- The cluttered layout of maps.
- An overwhelming display of maps with users, hazards, traffic, police traps, and accidents can populate the mobile screen.
- Ads pop, accumulating points ding, and routes are re-routed because of drive-by incidents.
- Encouraging scofflaws.
- Limited accuracy as a result of ambiguities and flaws in location data.

API

APIs have existed since the advent of the personal computer. APIs were originally designed to facilitate communication between two or more programs. The emergence of APIs on the web was around the year 2000. APIs have piqued the interest of practitioners and scholars since then, to the point where some analysts believe that we now live in the API economy. APIs are widely used in the mobile application business, which is one of the fastest-expanding sectors of information technology. APIs are generally used by mobile app developers to create trustworthy and compatible applications. Despite these advancements, academics have yet to assess the present status of API research to give guidance for future studies. As a result, the current study aims to give an overview of existing API research to assess the status of the field and guide future research [4, 5].

When utilizing a mobile phone application, it establishes a connection to the Internet and transmits data to a server. Subsequently, the server receives, interprets, and processes the information, taking necessary actions before sending the processed data back to your phone. The application software then analyses the received data and presents the requested information in a readable format. This entire process is facilitated through an API, encapsulating the essence of what an API is.

Types of API

APIs come in many forms. When building a new API, API designers have a variety of protocols and standards to select from, based on the type of API and its purpose.

Web APIs: APIs accessible through the HTTP protocol are referred to as Web APIs. These APIs define specific endpoints and outline the acceptable formats for both requests and responses. The APIs used to connect with the browser are referred to as web APIs. There are four different types of web APIs:

- **Open APIs:** Access to these sorts of APIs, often known as Public APIs, is unrestricted because they are open to the public. They may or may not require registration or the usage of an API key, and they may or may not be open.
- **Partner APIs:** Because certain APIs are not open to the public, a developer must have particular permissions or licenses to utilize them. These tokens are often generated with a particular objective, such as providing access to premium services. In the software-as-a-service landscape, this paradigm is commonly observed.
- **Internal APIs:** Also known as Private APIs. External users are not allowed access to internal APIs. These are generally created for a company's internal usage. Security and access management, a log of system access, and a unified interface for connecting various services are all benefits associated with the utilization of internal APIs compared to traditional integration approaches.
- **Composite APIs:** Developers can initiate a consolidated request to multiple endpoints using Composite APIs. These might be several services or data sources, or they could be separate endpoints of a single API. Its primary functions are to speed up the execution process and to increase the performance of listeners in web interfaces.

Navigation API

After the departure and destination locations have been determined and a route has been calculated, navigation APIs are used to control the finer points of navigation (via a Directions API). A navigation system, particularly for connected automobile computer systems, depends significantly on event analytics and road condition analytics to improve routing to a destination. A Navigation API, for example, considers factors like as fuel consumption and road closures, and employs turn-by-turn navigation to determine the most efficient route to save time and money; this is generally the greenest path.

A Navigation API is a programmatic interface that allows software developers to get the data they need to create routing applications, from identifying places and displaying maps to offering instructions and personalizing itineraries.

Navigation API Use Cases

- **GPS Navigation Software:** Apps like Waze employ Navigation APIs to help drivers find the shortest and safest route to their destinations. Weather and road conditions, road closures and obstructions, traffic-aware routing, waypoints, and other considerations are all taken into account by smart navigation.
- **Retail Guidance:** When used in conjunction with other location-based services, Navigation APIs may direct customers to businesses and advise them of the ideal times to shop, such as when there are no lines, local deals, or the quickest route to avoid traffic jams on key highways.
- **Fleet Management:** Transportation organizations may use a Navigation API to establish a location grid, mapping the most effective routes for truck drivers and travelling salesmen, and increasing customer care and support [6].

Distance Matrix API

The Distance Matrix API estimates the distance and time between two or more addresses using various modes of transportation such as driving, walking, bicycle, and public transportation.

Directions API

Similar to the Distance Matrix API, the Direction API allows you to determine the trip distance and time between two or more places.

We can generate a directed route on the map based on various transit modes using its client-side library.

Google Maps API

The map with the most data shows all roadways in every mode, including automobiles, heavy trucks, railroads, bicycles, and pedestrians. To acquire the directions, all you have to do is get a key and utilize the API. The Google Maps API is a series of application programming interfaces (APIs) that allow us to interact with the company's services. It will enable us to create everything from simple Web apps to complex location-based apps for iOS and Android. Google Places API allows online and mobile app developers to personalize their searches by:

- Using a keyword search and/or filters; or
- Ranking results by distance and popularity.

The Google Maps API V3 is a powerful tool for delivering digital cartographic data to Internet users, with fast response times and user-friendly interactions. The user can select one of two map kinds using Google Maps' basic Map Type control: Satellite images or a map [7].

Applications of Google Maps

- People need directions to get where they wish to go. Whether individuals are driving, walking, cycling, or using public transportation, they could plan their journeys and obtain an approximate estimate of the travel duration. You may create optimized routes for users, such as delivery drivers, who need to visit several sites throughout the day, by inserting Waypoints-extra locations the user wishes to pass via.
- *Geocoding*: By translating between street addresses, latitude, and longitude coordinates, geocoding makes it simple to precisely indicate locations on maps. Instead of four homes away, you can locate a building precisely.

CASE STUDY

We have built a navigation application that allows users to create an account, and first it ensures it is a human filling the form and not a robot. On successful verification of form submission by Google reCAPTCHA version 3 the user will be able to create an account and also save and update the personal information on the account page. The application then asks the user to enter the origin and destination including two waypoints near the chosen origin and destination to ensure the user is not directed towards ambiguous locations and enhance the reliability of the application. The user when enters the data will be shown pre-populated data to make the selection of the location even more easy and swift. After the entries are filled, the user is directed to a route page where detailed information about the commute is provided which includes the distance travelled, duration of the travel and geocodes of the destination. On clicking maps, a URL is created that renders a map which then shows every single step between origin and destination with time distance and directions. This is our application Personal Map Depict which helps users to save time in their everyday life by easing the process of navigation [8, 9].

A great opportunity comes once in a while and to grab it at the right time is the real game and this is what our application exactly does. We have built this application using Python and Django. Six different APIs have been implemented in this application which are places API, distance matrix API, directions API, geocoding API and maps JavaScript API. We have used Sublime text and code editor for this application.

PROPOSED SOLUTION

With the increasing need for efficient navigation in daily life, web mapping platforms are gaining immense importance for users all around the globe.

Personal Map is a navigation web application that is built using Django and integrates six different Google APIs. Our application enables new users to sign up and create and save their information. For

existing users, we have a sign in option to update and re-save their information. For new users, our application uses recapture version three software to score the form submission hence ensuring that a real person has entered information and there is no robot. There will also be a message pop-up to verify the form submission is successful and then the user will be redirected to the user account page. On updating the profile with an address, on typing down the address the application will pre-populate the result which emphasizes on friendly user-interface. In our application we provide options to submit the origin and destination and also the way points which will help confirm the place the user is trying to achieve. Further, in our application on submitting the locations the distance to be travelled and duration will be provided and a map will be rendered. And we also provide every single step from origin to destination.

We have maximum emphasis on efficient user interface and experience by following a design that does not show flashy pop-up messages and patterns that are minimalistic and comfortable to work with. The utmost importance is given to ensuring the destination chosen is exactly what the user wishes to reach. In our application, the navigation is in easy-to-understand infographics and aims to provide the best quality experience to the users and hassle-free travel [10].

CONCLUSION

Personal Map Depict helps save time and energy in the user's life with an easy-to-understand user interface and travel freely without stress. In every person's life, daily commute is an integral part of life and our project is the perfect solution for this.

Saving time from the hectic schedule in life can help people work effectively and efficiently. Having the power to organize the day by knowing the detailed information on route and time is a step towards calm and successful living.

The addition of our application by end-users in real life will cultivate the habit of safe and efficient travel by organizing the entire schedule of the day. The real world is always progressing speedily and to stand a chance to catch the life-changing opportunity it is essential to reach on time which is the idea behind our application.

Future Prospects

We will develop the system into a web application or mobile software in the future. So, if we look at our application in future, there are a lot of things that can be changed:

- It is possible to build a mobile application for staff and management by requesting access to the required information.
- Results with information that will be stored in the cloud can be generated. Big data is going to be very much in use.
- To make the system more interactive with the employees, a feedback port can be added.

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