

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

A geo-tagged picture includes geographical information such as its latitude and longitude and a timestamp of when the picture was created. The information is stored in the image's EXIF. EXIF stands for Exchangeable Image File Format. EXIF data is a kind of hidden tag within the image file that can hold various details about the file, such as GPS Longitude, GPS Latitude, GPS TimeStamp, GPS Altitude, GPS Position, DateTime Original, Resolution, and many more. The GPS latitude and longitude coordinates help us identify the location information of the image file. The coordinates, which are in degrees, will be converted into decimal values to extract the exact location where the image was taken. We also extract the pin code of the location, through which we can further extract the district name and state name. There are two main ways a picture can become geotagged:

1. Automatically
 - i. Automatic Geotagging using a built-in GPS
 - ii. Automatic Geotagging using a connected GPS
2. Manually

Many smartphones and some cameras come with built-in GPS. When we take a picture with this enabled, the device captures the location data and embeds it into an image file. This eliminates the need for any external equipment or manual tagging later. The GPS receiver communicates with satellites that are orbiting around the earth to determine the exact location, which includes both latitude and longitude coordinates. The moment we capture a picture, the GPS data is directly embedded into the EXIF data of the image file and becomes part of the image file.

We can also add geotags to pictures later on. There are various software programs and online tools that allow us to input the location information for an image, even if it wasn't geotagged when it was taken. The information can be entered by directly giving the coordinates or by selecting a location from a map using software tools. Some tools allow us to enter tags like city, postal code, or street address.

Manual geotagging also presents the possibility of inaccuracy, in which a photograph's location is incorrectly represented by incorrect coordinates. To identify and flag such photos, an advanced comparative analysis of such photos with the total collection set of all photos available from the surrounding coordinates is required; however, the value, need, and purpose of such software may be limited in today's environment, where almost every smartphone and camera has geotagging built-in and users do not need to manually enter this information.

1.2 OBJECTIVES

- Helps to identify where activities or content are taking place.
- Improves user experience with wayfinding and navigation.
- Promotes accessibility, group, and classify content according to its geographical location.
- Encourages individualized experiences, regulatory compliance, and emergency response.

1.3 METHODOLOGY

Step - 1:

Click on Choose file.

Step - 2:

Choose a geo-tagged picture.

Step - 3:

Select the picture you've chosen.

Step - 4:

Upload the file you've selected.

CHAPTER 2

LITERATURE REVIEW

Geotagging is the process of adding geographical information to the media. This geographical information includes attaching the longitude and latitude of where the picture was created. It also includes the time stamp. All this data will be embedded into the file. While geotagging might be a useful tool, it's necessary to consider privacy concerns. Sharing our location data might cause problems, therefore it's best to manage our geotagging settings on gadgets and social networking platforms. We can typically stop geotagging totally or restrict who can view our location data. The accuracy of geotags depends on factors like GPS signal strengths. Stronger GPS signals lead to more precise locations. Device capabilities: some devices already have a GPS chip, and they tend to be more accurate than older models. Environmental factors, such as buildings and trees, can weaken the strength of GPS signals. Several studies look into the technical aspects of geotagging, such as GPS functionality, metadata integration, and location accuracy (1: "[A Survey on Geotagging in Multimedia and Computer Vision]" by Qingquan Li et al., 2008). Theodoros Oikonomidis et al. (2019) provide a review of smartphone geolocation technologies, emphasising the rising accuracy and capabilities of GPS chips in mobile devices 3: "[A Literature Review of Smartphone Geolocation Technologies]". In addition to practical concerns, researchers investigate geotagging's numerous applications. Social media platforms utilize geotags to improve user experience and content discovery (4: "Geo-Tagging in Social Media" by Usman Qazi et al., 2011). Paulos et al. (2010) investigate the impact of mobile geotagging on urban areas, specifically how geotags can modify human interactions with physical environments. 2. "Mobile Geotagging: Reexamining Our Interactions with Urban Space" by Lucy Paulos, James Gross, and Elizabeth D. Mynatt (2010).

CHAPTER 3

IMPLEMENTATION

3.1 ALGORITHM

A geotagged image that the user submits through the input interface gets saved in the static directory. With the help of the `getctime()` method, we can display the result of the file that has been uploaded recently. The image path will be supplied to the `home` function, from which we extract the metadata details (latitude, longitude, and timestamp) with the use of the `Exif-read` function. To obtain the precise position, latitude and longitude will be transformed into decimal values. Once we have the location, we locate the pin and use an API to retrieve the state and district from the pin that has been generated.

ADVANTAGES

Geotagging has several advantages, both personally and professionally.

Enhanced Personal Organization:

Memoir Creation, Geotagged photographs, and videos can act as a potent memory trigger, allowing you to effortlessly revisit places and memories via the lens of location. Imagine having a travelogue in which your images automatically generate a map of your adventure!

Efficient sorting means no more hunting through endless folders. Geotags allow you to sort and filter your images based on where they were shot, making it easy to find the perfect beach photo from your summer vacation.

Content sharing and discovery:

Location-based storytelling, sharing geotagged content on social media helps you to create more detailed stories. You can virtually accompany your followers on your journeys, allowing them to experience the locations you visit.

Increased searchability, when you geotag your content, it becomes discoverable to those looking for information or postings about that precise location. This is especially useful for businesses or people looking to promote local events or attractions.

Demands in different fields:

Geotagging allows businesses to offer location-specific promotions and contact lines in specific areas. Consider a restaurant that provides discounts to nearby customers! Geotag data is useful in environmental science animal monitoring and other research areas. Researchers can acquire a better understanding of different processes by tracking the location of specific atoms.

For improved public services, the Department of Public Works and Highways, for example, might use geotagged data to follow road maintenance projects and identify problem areas.

Data Analysis and Insights:

Geotagged data is extremely valuable for a wide range of data analysis uses. Companies can monitor foot traffic in actual stores, examine local social media trends, and focus advertising campaigns on certain demographics. Geotagged data can be used by scientists researching wildlife migration patterns or urban planners looking at traffic patterns to obtain important insights.

DISADVANTAGES

While geotagging has numerous advantages, there are also drawbacks to consider.

Privacy Issues:

Stalking and unwelcome attention, and sharing your whereabouts online, particularly in real-time, can cause a safety concern. It may expose you to stalkers or unwanted attention especially if you're settings are not properly adjusted. Sharing too much information, geotags, particularly when combined with social media posts, can provide a thorough picture of your daily routine and location. This may be problematic if you value your privacy.

Security Risks:

Targeted robberies: Sharing your whereabouts in real time, particularly when combined with details about valuable goods may make you a target for Burglary or theft.

Identity theft:

Geotagged images may show your home location in the background, increasing the danger of identity theft if not handled carefully.

Battery Drain:

The continuous access to your location data by geotagging apps can seriously shorten the life of your battery. For people who depend on their cell phones all day, this may be cause for alarm.

APPLICATIONS

- Social media sharing
- Environmental monitoring
- Travel and personal organization
- Scientific research

3.2 SOFTWARE REQUIREMENT SPECIFICATION

In the field of software development, software Requirement Specification (SRS) is an essential document. It outlines everything that the software should be and be able to accomplish, kind of like a blueprint. The purpose of this official document is to facilitate communication among Several project stakeholders such as clients, developers, and testers.

The SRS makes sure the program meets the needs of the client or customer by outlining its capabilities. It serves as a roadmap for developers, helping them to understand what features to add and how the program should work. To check whether the finished product satisfies the requirements testers rely on the SRS to generate test cases.

HARDWARE DESCRIPTION

RAM: 4.0 GB

CPU: Core i3 processor

Hard Disk Space: 128 GB

SPECIFICATIONS FOR SOFTWARE

ExifTool

Flask web Framework

Python

3.2.1 TECHNOLOGY DESCRIPTION

HTML

HTML is the shorthand for Hypertext Markup Language. HTML combines hypertext with markup language. HTML is a markup language for producing web pages. HTML is understandable to humans. HTML tags are used to customize how text and images are displayed. HTML teaches browsers how to display webpages by utilizing specified tags and components. The fundamental elements are HTML, head, title, and body. The closing tag corresponds to the html root element. The root element contains all other HTML components.

HTML's main feature is hypertext, which lets us link web pages together. These links, which we have probably noticed as underlined text, might lead us to new web pages or to different portions of existing web pages when we click on them. HTML makes use of markup language as well. To specify the content and organization of a webpage, HTML employs unique tags that are enclosed in angle brackets. These tags are paired, meaning that the browser is told how to display the content between them by the opening and closing tags.



Fig. 3.1 Home page

The user should click on Choose File to choose a picture. When the user clicks on the Choose File button, it opens the user file explorer to select a picture that is geo-tagged, and then when the user clicks the Upload File button, the picture will be uploaded into the static directory. As the picture is uploaded, with the help of the `getctime()` method, its path will be copied, and with the help of the subprocess module, we can extract the required parameters from the ExifTool.

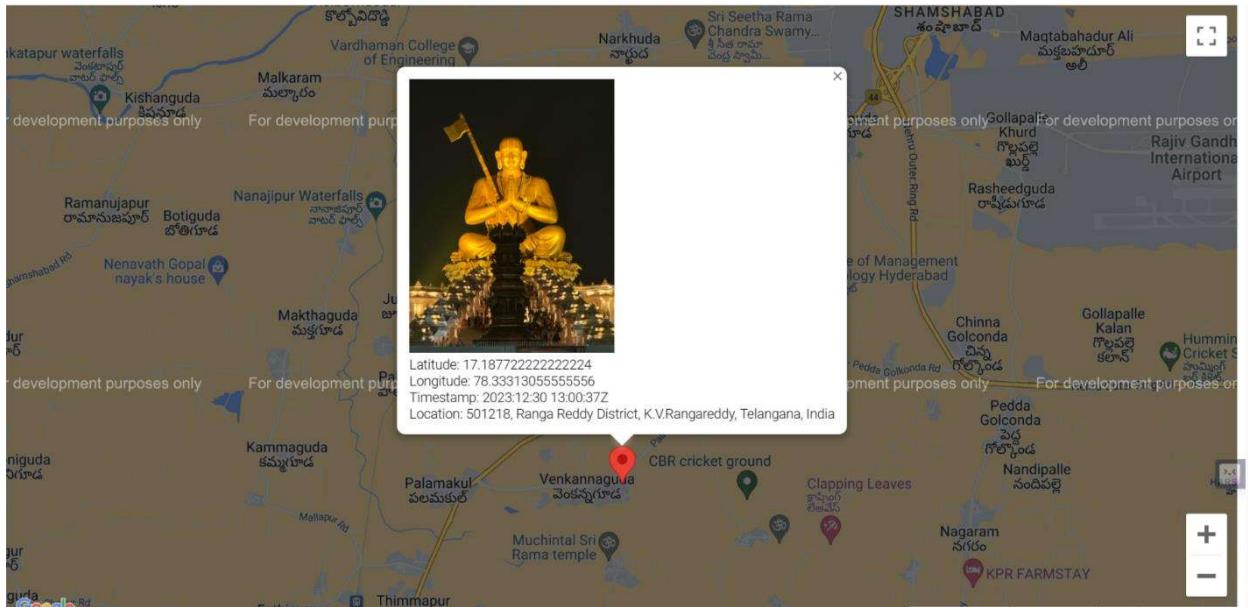


Fig. 3.2 Output page

The output page shows the provided image in the maps where it was taken, together with the position, latitude, longitude, and creation date.

CSS

CSS, or Cascading Style Sheets, is a computer language that defines the appearance and formatting of a document written in a markup language such as HTML or XML. It allows us to separate the content of a web page from its look (specified in CSS). Global styles applied to all elements using the asterisk (*) selector removes any default margin and padding, creating a clean starting point for further styling. Paragraph styles specifically target `<p>` elements, defining a black border, white text on a blue background, and a subtle shadow effect. Body element styles set the overall layout and webpage content area. The body is positioned relatively for potential future layout needs, and overflowing content is currently hidden (this might be adjusted for reports). A background image is set using a placeholder that likely gets filled dynamically by Flask. The background image won't

repeat, will cover the entire body area, and will expand to fill the width while maintaining its proportions. Finally, the body element itself stretches to 100% of the viewport width.

PYTHON

Python is an advanced and versatile programming language that is noted for its readability and ease of use for beginners. Unlike some languages with sophisticated syntax, Python structures code using plain, English-like keywords and indentation. This makes it easy to learn and comprehend, especially for people new to programming. Despite its simplicity, Python is a general-purpose language capable of performing a variety of tasks. It is frequently used in web development, data analysis, machine learning, scientific computing, automation, and other applications. Python has a large number of pre-written libraries and frameworks, allowing programmers to reuse existing code for common functions. Python's emphasis on code reuse and clarity makes it an appealing alternative for quick application development.

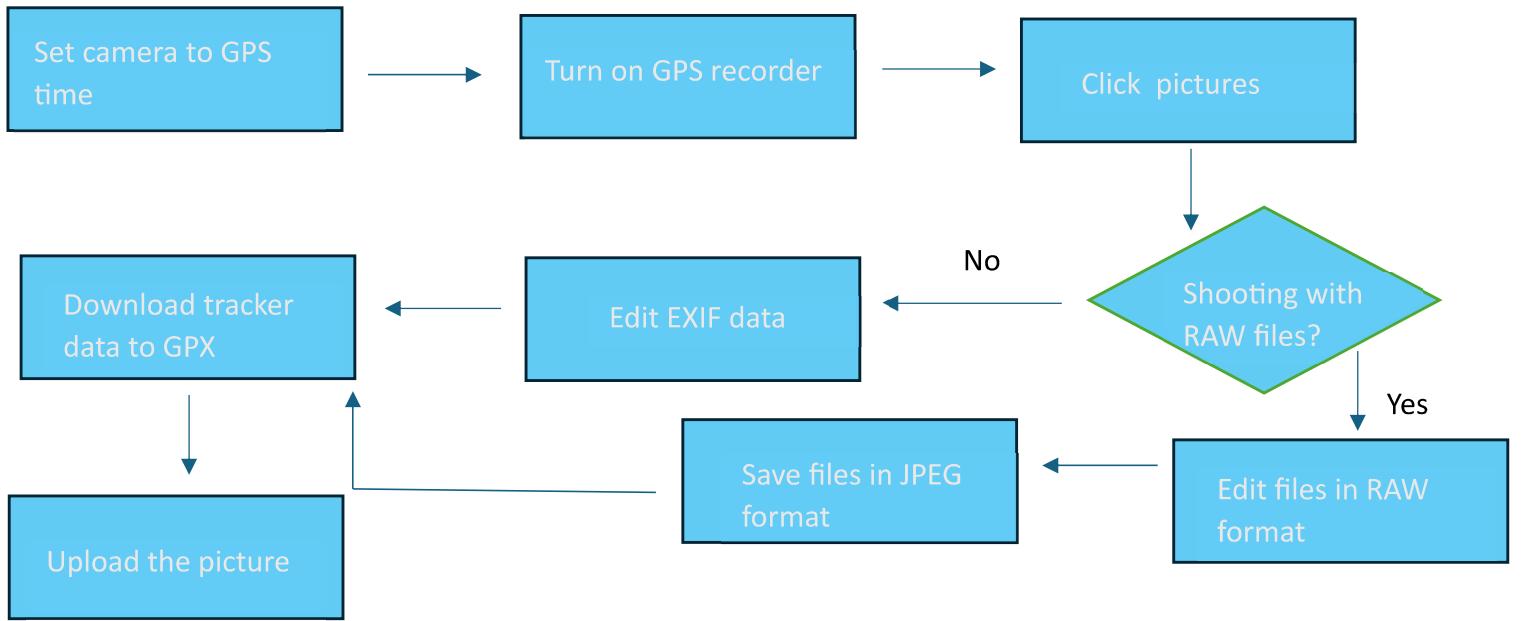
EXIFTOOL

ExifTool is a strong and adaptable software application made to manage the hidden information in your digital files behind the scenes. Consider it your decoder ring for images, movies, and even PDF files. The metadata that is encoded in these files and contains information like camera settings, timestamps, and position data (GPS tags) that is recorded at the time of production can be read, written, and altered by ExifTool. ExifTool gives you the ability to view and modify this metadata, even if you might not be able to see it directly. This has several advantages. It helps photographers improve their technique by analyzing the camera settings used in each shots. It can be used by journalists to confirm the location and timing of images that sources have submitted, guaranteeing their legitimacy. ExifTool is a free utility that functions for your images and other files as a digital detective. Surprisingly, it can extract a lot of hidden information from them, such as the software used to produce a document, the date, aperture, and exposure of the camera used to shoot the photo or even hidden remarks. You can inspect this data with ExifTool, modify portions of it, and even copy it from one file to another.

GOOGLE MAPS API

For developers looking to integrate Google Maps functionality into their applications and websites, the Google Maps Platform offers a toolkit of resources. There are numerous APIs (application programming interfaces) in this toolset. Application Programming Interfaces, or APIs, serve as an interface between our project and Google Maps' extensive feature set. With the help of these APIs, we can integrate interactive maps into our platform so that we can look up locations, find our way around, see data with personalized marks, and even take advantage of features like Street View for a more engaging experience. Simple map displays to elaborate location-based services are all supported by the Google Maps Platform APIs. Whether we're developing a delivery service app, real estate listing platform, or trip booking software, the Google Maps Platform APIs provide the means to improve our experience through clear and educational mapping.

3.3 FLOW CHART



CHAPTER 4

EXPERIMENTATION AND RESULTS

4.1 EXPERIMENTAL WORK

Within my project, we generate the latitude, longitude, timestamp, and the area where a user-provided geotagged photo was taken.

4.1.1 IMPLEMENTATION OF CODE

```
import json
import requests
import subprocess
from geopy.geocoders import Nominatim
from flask import Flask, render_template
from flask_wtf import FlaskForm
from wtforms import FileField, SubmitField
from werkzeug.utils import secure_filename
import os
from wtforms.validators import InputRequired

app = Flask(__name__)
app.config['SECRET_KEY'] = 'supersecretkey'
app.config['UPLOAD_FOLDER'] = 'static\\'

class UploadFileForm(FlaskForm):
    file = FileField("File", validators=[InputRequired()])
    submit = SubmitField("Upload File")
p1 = '/static/world-map.jpg'
@app.route('/', methods=['GET','POST'])
```

```

def home():
    form = UploadFileForm()
    if form.validate_on_submit():
        file = form.file.data

        file.save(os.path.join(os.path.abspath(os.path.dirname(__file__)),app.config['UPLOAD_FOLDE
R'],secure_filename(file.filename)))

    expected_path = get_top_image_from_static()
    image_path = f'C:/Users/Saray/Downloads/MINI PROJECT2/static/{expected_path}'
    metadata = exif_read(image_path)
    latitude = metadata['GPS Latitude']
    longitude = metadata['GPS Longitude']
    if 'GPS Date/Time' in metadata:
        timestamp=metadata['GPS Date/Time']
    elif 'Date/Time Original' in metadata:
        timestamp = metadata['Date/Time Original']
    else:
        timestamp = metadata['GPS Time Stamp']
    lat = convert_to_decimal(latitude)
    long = convert_to_decimal(longitude)
    location_info = reverse_geocode(lat, long)
    pin=str(location_info['pin'])
    print(pin)
    ENDPOINT = "https://api.postalpincode.in/pincode/"
    response = requests.get(ENDPOINT+pin)
    pincode_info = json.loads(response.text)
    area=location_info['area_name']
    country=location_info['country']
    state = pincode_info[0]['PostOffice'][0]['State']

```

```

district = pincode_info[0]['PostOffice'][0]['District']
location=f" {pin}, {area}, {district}, {state}, {country}"
path = f/static/{expected_path}'
return render_template("Geo.html", latitude=lat, longitude=long, path =
path,timestamp=timestamp,location=location)
return render_template('index.html', form = form, path = p1)

```

```

def get_top_image_from_static():
    static_dir = 'static'
    image_files = [f for f in os.listdir(static_dir) if os.path.isfile(os.path.join(static_dir, f)) and
f.lower().endswith('.png', '.jpg', '.jpeg', '.gif'))]
    dict = {}
    for i in image_files:
        var = os.path.getctime(f"static/{i}")
        dict[var] = i
    var = sorted(dict.keys())
    return dict[var[-1]]

```

```

def exif_read(img):
    com = r'C:\Program Files\EXIFTOOL\exiftool.exe'
    command = [com, img]
    try:
        process = subprocess.Popen(command, stdout=subprocess.PIPE, stderr=subprocess.PIPE,
text=True)
        output, error = process.communicate(timeout=20)
        data = {}
        if output:
            for line in output.splitlines():
                key, value = line.split(':', 1)
                data[key.strip()] = value.strip()
    else:

```

```

        return "No output from ExifTool"

    if error:
        return "Error"

    return data

except subprocess.TimeoutExpired:
    process.kill()
    return "Process killed due to timeout"

except Exception as e:
    return "Error"

def convert_to_decimal(coord_str):
    parts = coord_str.split(' ')
    degrees = float(parts[0])
    minutes = float(parts[2][:-1])
    seconds = float(parts[3][:-1])
    direction = parts[4]
    decimal_degrees = degrees + minutes / 60 + seconds / 3600
    if direction in ['S', 'W']:
        decimal_degrees *= -1

    return decimal_degrees

def reverse_geocode(latitude, longitude):
    try:
        geolocator = Nominatim(user_agent="reverse_geocode")
        location = geolocator.reverse((latitude, longitude), exactly_one=True)
        address = location.address.split(',')
        print(address)
        pin = None
        area_name = None
        country = None
        for component in address:

```

```
if component.isdigit():
    pin = component
elif component.isalpha():
    country = component
else:
    area_name = component

return {
    'pin': pin,
    'area_name': area_name,
    'country': country
}

except Exception as e:
    print("Error:", e)
    return None

app.run()
```

4.2 RESULTS AND DISCUSSION

4.2.1 INPUT INTERFACE



Fig. 4.1 Input Interface

The above picture shows the input interface. It consists of two buttons, namely, "choose file" and "upload file." The user should click on Choose file to choose a picture, and then click on upload to upload the picture into the static directory.



Fig. 4.2 File Selection

When the user clicks on the choose file button, it opens the file explorer to select a file. The file can be in the format of PNG, jpg, jpeg, and gif. After selecting the file and clicking open, the file explorer disposes itself.



Fig. 4.3 Uploading the file

After selecting the file, when the user clicks on the Upload File button, the selected file will be uploaded into the static directory. With the help of the `getctime()` method, we can display the result of the file that has been uploaded recently. With the help of the subprocess module, we can extract parameters such as latitude, longitude, and time stamp from the ExifTool.

4.2.2 OUTPUT INTERFACE

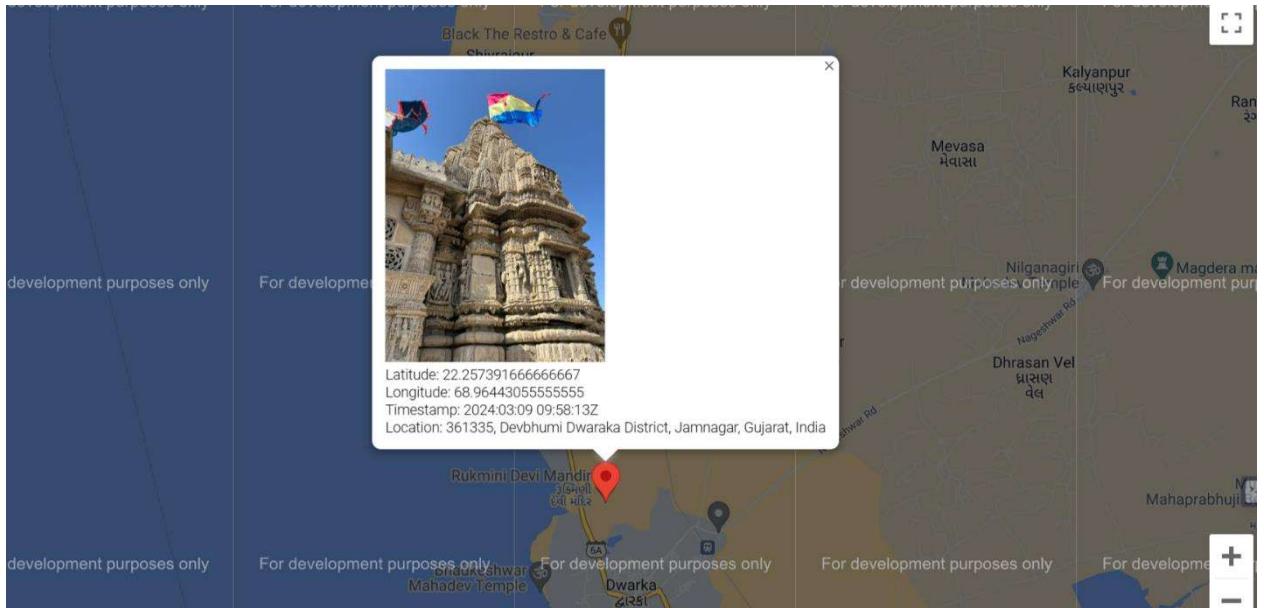


Fig. 4.4 Output Interface

The output page displays the given picture in the maps where it has been captured, along with the latitude, longitude, timestamp, and location of where it has been created. Latitude and longitude coordinates that are extracted from the metadata will be converted into decimal values to display the precise location.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

I conclude that geotagging has proved itself as a powerful and versatile technology with applications that extend well beyond social media photo sharing. It provides considerable advantages for organization, information sharing, and location-based applications. However, privacy concerns remain an important factor to address. Geotagging has a bright future ahead of it. Sensor technology advancements and integration with the Internet of Things promise improved accuracy and a broader range of applications. As geotagging evolves, it becomes increasingly vital to balance its utility and individuals' privacy. Responsible development and user awareness will be critical for realizing the full potential of this revolutionary technology. With applications that permeate every aspect of our lives, geo-tagging has become a powerful and adaptable technology. Although it was first popularized by social media photo sharing, geotagging has several benefits outside of social media. On a personal level, it can make organizing memories easy. Geotagging makes accurate information interchange easier, particularly in fields like environmental research and media. It also promotes the development of state-of-the-art location-based applications that integrate seamlessly with our daily routines. On the other hand, privacy concerns are still a significant issue that require attention.

5.2 FUTURE SCOPE

Imagine a more immersive travel experience where you can return virtual tours of your journeys by having images of your travels automatically tag places. Imagine social media that allows you to share where you have been as well as what you have seen, resulting in more meaningful interactions and trip suggestions. Beyond entertainment, geotagging can help scientists track changes in the ecosystem or endangered animals by using tagged wildlife images. Additionally, it can enhance public safety by enabling law enforcement to locate incidents that are photographed. Geotagging's future depends on using this data to build a more comprehensive picture of our world, including everything from individual recollections to worldwide patterns. With ongoing developments in sensor technology and its integration with the Internet of Things (IoT) opening up a world of creative applications, geotagging has a lot of potential in the future. Improved precision and accuracy in geotagging, together with IoT connectivity, could transform a number of businesses. Geotagging is destined to become ubiquitous in several spheres of our life, ranging from smart city infrastructure and personalised services to asset tracking and sophisticated location-based apps. To fully realise the potential of this innovative technology, it will be necessary to strike a careful balance between the practicality of geotagging and protecting individual privacy, highlighting responsible development practices and raising user awareness of privacy implications.