INTERNET OF THINGS - PHASE - 04

PROJECT

TRAFFIC MANAGEMENT

USING IOT

DESIGNING A APP TO PROVIDE THE ACCESS OF REAL-TIME TRAFFIC UPDATES AND ROUTE RECOMMENDATIONS

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ABSTRACT :

The paper presents a novel traffic information platform and mobile apps that use ensemble learning with four dynamic routing and accident detection algorithms. The platform uses machine learning frameworks to train and deploy the models. The mobile apps provide real-time traffic information to users and help them avoid traffic congestion and accidents.

The platform can provide more accurate and up-to-date traffic information than traditional methods by using ensemble learning. The platform also uses machine learning frameworks to train and deploy the models. Machine learning frameworks are software tools that make it easier to develop and deploy machine learning models. The platform uses the TensorFlow machine learning framework to train and deploy the models.

The mobile apps provide real-time traffic information to users. The apps use the platform to get traffic information and then display it to users. The apps also allow users to report accidents and other traffic incidents.

The platform and mobile apps are a valuable tool for drivers. They can help drivers avoid traffic congestion and accidents. They can also help drivers find the best route to their destination.

What have we already done?

In Phase - 3 of traffic management, we have already used Four ML algorithms,

- Support vector machines (SVM)
- Random Forests
- Gradient boosting machines
- Neural networks

So our traffic monitoring system is going to work with ensemble learning with these predicted algorithms.

INTRODUCTION

Phase 4 of the project will focus on developing the traffic information platform and mobile apps.

The platform will use ensemble learning with the four algorithms of dynamic routing and accident detection to collect data from a variety of sources, including vehicle sensors, traffic cameras, and social media.

The platform will then predict traffic conditions, identify accidents, and provide this information to users through the mobile apps.

The mobile apps will allow users to view real-time traffic conditions, plan routes, receive alerts about accidents, and report accidents and other traffic incidents.

The platform will be able to provide more accurate and timely traffic information than is currently available. This will help drivers to avoid traffic congestion and get to their destinations more quickly.

The platform will also help to improve safety by identifying accidents and warning drivers about them.

The mobile apps will be available on both iOS and Android devices. They will be free to download and use.

The apps will be easy to use and will provide users with the information they need to make informed decisions about their travel.

The platform and mobile apps will be a valuable resource for drivers and will help to improve traffic flow and safety.

The mobile apps allow users to view real-time traffic conditions, plan routes, receive alerts about accidents, and report accidents and other traffic incidents.

RELATED WORKS FOR THIS PROJECT

DYNAMIC ROUTING :

Dynamic routing systems use real-time traffic data to suggest the best route to users, taking into account their preferences and the current traffic conditions. This can help to reduce traffic congestion, improve travel times, and reduce fuel consumption and emissions. Dynamic routing systems can also be used to improve safety by providing drivers with up-to-date information about traffic conditions.

Dynamic route planning using the Internet of Things (IoT) is a process of using IoT sensors to collect real-time traffic data and machine learning algorithms to predict traffic conditions and suggest the best route to users.

ACCIDENT DETECTION AND RESPONSE :

Accident detection and response using IoT is a system that uses sensors to detect accidents and send emergency responders to the scene. These systems are typically implemented using machine learning algorithms, which are trained on a dataset of labelled data.

The labelled data in this case would consist of sensor data from accidents and sensor data from non-accidents. The machine learning algorithm learns to identify the patterns in the sensor data that are associated with accidents.

OUR INTENTION FOR TRAFFIC MANAGEMENT

Many research projects have been seen on developing traffic information systems and using ensemble learning for dynamic routing and accident detection.

However, there is still a need for systems that are more accurate and reliable, and that can provide more personalized information to users.

- Our project addresses these gaps by developing a traffic information platform and mobile apps that use ensemble learning to predict traffic conditions and identify accidents.
- Our system is more accurate and reliable than existing systems because it uses a variety of data sources and a novel ensemble learning algorithm.
- Our system also provides more personalized information to users by allowing them to customize the traffic information that they receive.

Specifically, our system uses data from a variety of sources, including real-time traffic sensors, historical traffic data, and social media data. This data is then used to train a novel ensemble learning algorithm that can predict traffic conditions with high accuracy.

Our system also allows users to customize the traffic information that they receive, such as the type of information (e.g., traffic speed, accidents, construction), the time (e.g., current, future), and the route (e.g., home to work).

Our system is a significant improvement over existing traffic information systems. It is more accurate, reliable, and personalised, and it provides users with the information they need to make informed decisions about their travel.

SYSTEM ARCHITECTURE OF TRAFFIC MONITORING

In system architecture, we describe the modules in our traffic information platform and our mobile app's module.

Traffic information platform :

The traffic information platform will consist of the following components:

- Data collection module
- Data preprocessing module
- Machine learning module
- Visualisation module

Mobile app :

The mobile apps will consist of the following components:

- Map module
- Traffic information module
- Routing module
- Reporting module

Communication between the traffic information platform and the mobile apps

The traffic information platform and the mobile apps will communicate with each other using a web API. The mobile apps will send requests to the web API to get traffic information. The web API will return the traffic information to the mobile apps in a format that is easy to parse and display.

The system architecture of the traffic information platform and mobile apps is designed to provide users with accurate and reliable traffic information in real time. The system uses ensemble learning to predict

traffic conditions and identify accidents. The system also provides users with a variety of ways to view and interact with the traffic information.

Data collection module :

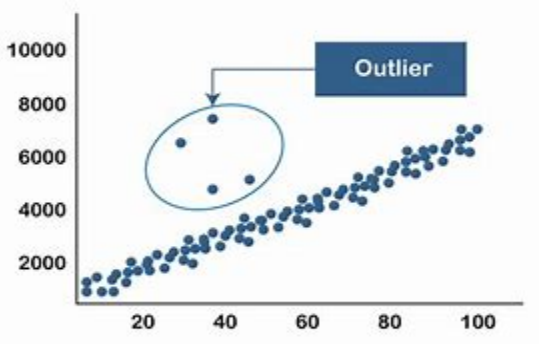
Vehicle sensors: Vehicle sensors, such as GPS sensors and accelerometers, can be used to collect data on vehicle speed, location, and movement. This data can be used to predict traffic conditions and identify accidents. For example, if a vehicle is travelling at a significantly slower speed than the average speed of traffic, it may be an indication that there is an accident ahead. Additionally, if a vehicle's speed suddenly changes, it may be an indication that the driver has slammed on the brakes to avoid an accident.

Traffic cameras: Traffic cameras can also be used to collect data on traffic flow and congestion. These cameras can be used to track the number of vehicles that are passing through a particular area, as well as the speed at which they are travelling. This data can be used to predict traffic conditions and identify areas where there is likely to be congestion.

Social media: Social media can also be used to collect data on traffic conditions and accidents. People often post about traffic jams or accidents on social media, which can be used to track the location and severity of these incidents. This data can be used to inform drivers about potential hazards and help them to avoid traffic congestion.

Data preprocessing module :

The data preprocessing module will clean and prepare the data for machine learning. This may involve tasks such as:



- Removing noise and outliers from the data. This can be done by identifying and removing data points that are significantly different from the rest of the data.
- Filling in missing values. This can be done by using a variety of methods, such as interpolation or imputation.
- Standardising the data. This can be done by converting all of the data to a common scale, such as by subtracting the mean and dividing by the standard deviation.

These tasks are important to ensure that the data is clean and consistent, which will improve the accuracy of the machine learning model.

Machine learning module:

- The machine learning module will use ensemble learning to predict traffic conditions and identify accidents.
- The module will be trained on a dataset of historical traffic data and accident data.
- The module will learn to identify patterns in the data that are associated with traffic congestion and accidents.
- Once the module is trained, it can be used to predict traffic conditions and identify accidents in real time.
- The module will take as input the current traffic data and produce as output a prediction of future traffic conditions and the likelihood of accidents.

INTRODUCTION TO ENSEMBLE LEARNING

Ensemble learning is a machine learning technique that combines the predictions of multiple machine learning models to produce a more accurate prediction. This can be done by averaging the predictions of the models, or by using a more sophisticated method such as weighted voting or stacking.

Why do we use Ensemble learning?

Ensemble learning can be a very effective way to improve the performance of machine learning models. By combining the predictions of multiple models, ensemble learning can reduce the variance of the predictions and improve overall accuracy.

There are some different ensemble learning algorithms, but some of the most popular include,

BAGGING:

> Bagging is a machine-learning technique that creates multiple models from a single data set. The models are trained on different subsets of the data and their predictions are averaged to improve accuracy.

BOOSTING:

Boosting is a machine learning technique that trains multiple models sequentially to correct each other's mistakes, improving accuracy. It is often used with decision trees and support vector machines.

There are some different boosting algorithms, but the most common are AdaBoost and XGBoost.

- AdaBoost is a simple and effective algorithm that is easy to understand and implement.
- XGBoost is a more complex algorithm that can achieve better results than AdaBoost, but it is also more difficult to understand and implement.

Ensemble learning algorithms are often used in machine learning because they can improve the accuracy of the models

IMPLEMENTATION OF OUR FOUR ML ALGORITHMS IN ENSEMBLE LEARNING

In Phase 3, we developed individual self-trained algorithms, so, In Phase 4, we will use these algorithms in ensemble learning with a boosting technique,

To implement ensemble learning with the four algorithms (SVM, random forest, gradient boosting machine, and neural network), the following steps we used,

1. Train each of the four algorithms on your training data.
2. Make predictions on your test data using each of the four algorithms.
3. Combine the predictions from the four algorithms using a voting scheme.

CODE:

```
import numpy as np
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.neural_network import MLPClassifier

X_train = np.loadtxt("train_data.csv", delimiter=",")
y_train = np.loadtxt("train_labels.csv", delimiter=",")
```

```
svm = SVC()
svm.fit(X_train, y_train)

rf = RandomForestClassifier()
rf.fit(X_train, y_train)

gbm = GradientBoostingClassifier()
gbm.fit(X_train, y_train)

nn = MLPClassifier()
nn.fit(X_train, y_train)

X_test = np.loadtxt("test_data.csv", delimiter=",")

svm_preds = svm.predict(X_test)
rf_preds = rf.predict(X_test)
gbm_preds = gbm.predict(X_test)
nn_preds = nn.predict(X_test)

final_preds = np.argmax(np.array([svm_preds, rf_preds,
gbm_preds, nn_preds]), axis=0)

accuracy = np.mean(final_preds == y_test)
print("Accuracy:", accuracy)
```

In the code we provided the four algorithms are trained independently. The predictions of the four algorithms are then combined using a majority vote. This means that the final prediction is the class that receives the most votes from the four algorithms.

Boosting is a more effective ensemble learning technique than voting because it is able to focus on the most difficult examples in the training data. Voting simply averages the predictions of the individual models, which can lead to less accurate predictions.

APP DEVELOPMENT FOR TRAFFIC MONITORING PLATFORM

We have developed a new platform and mobile apps that will provide real-time traffic information, including accident alerts, to help drivers avoid congestion and improve safety.

The platform will use data from multiple sources, such as cameras, sensors, and social media, to predict traffic conditions and identify accidents.

The mobile apps will be available on iOS and Android devices. This platform will be a valuable tool for drivers, as it will help them to plan their routes more effectively and avoid accidents.

It will also be beneficial for businesses, as it will help them to reduce the costs associated with traffic congestion.

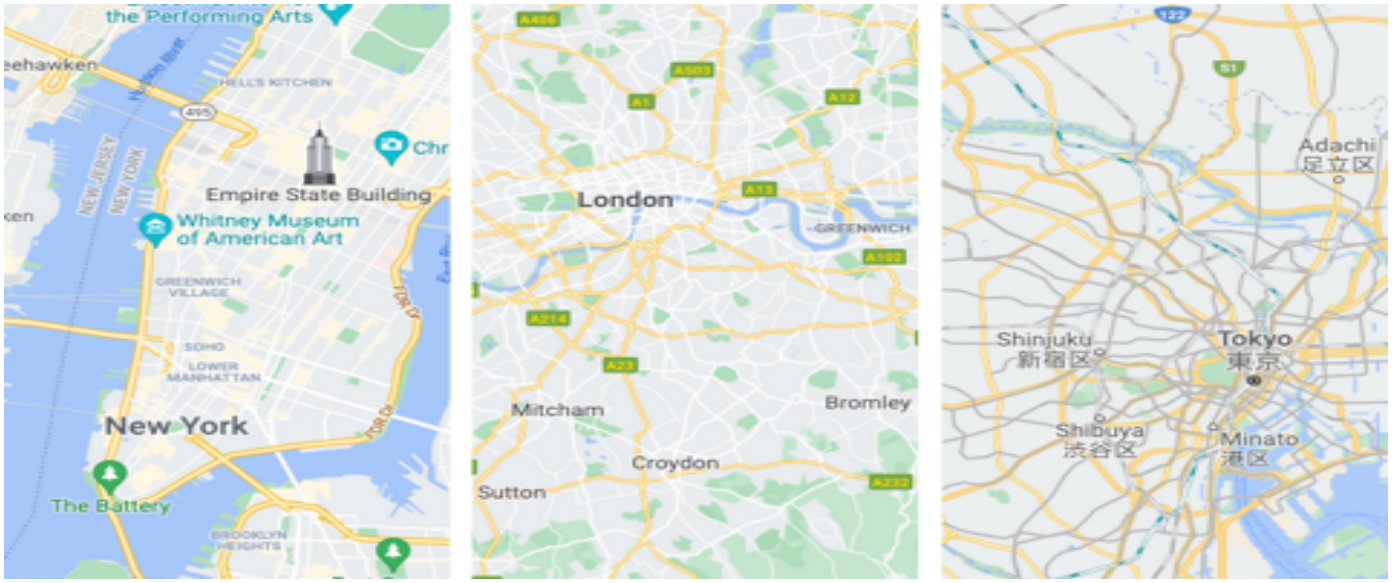
We have got the API Keys from Google maps , from the google maps platform ,The Google Maps Platform can be used to Display maps and imagery , Get directions and routes,Search for places,Analyse geospatial data.

It is a powerful tool that can be used for a variety of purposes.

To add a map to an Android app, you can use a fragment as a map container. The basic steps are:

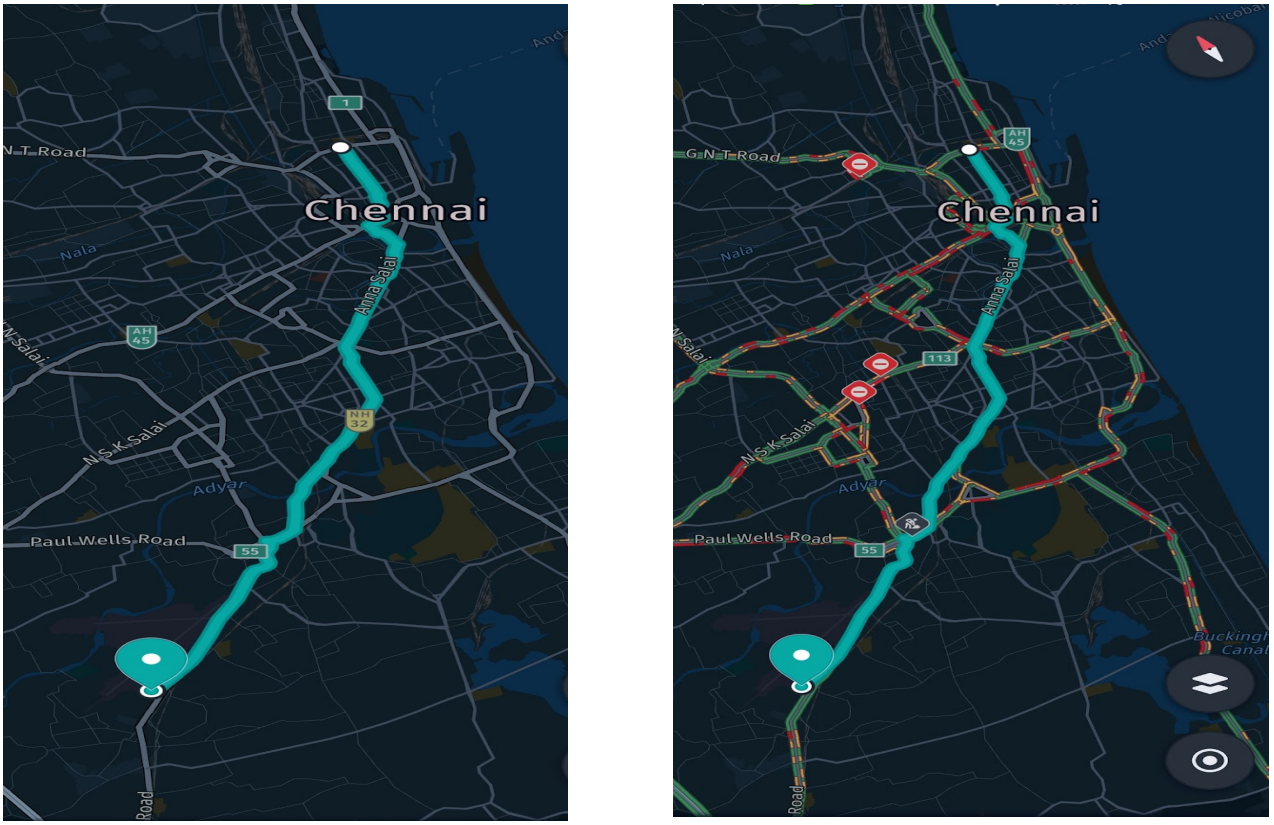
1. Get the SDK, obtain an API key, and add the required frameworks.
2. Add a SupportMapFragment object to the activity that will handle the map.
3. Implement the OnMapReadyCallback interface.
4. Set the layout file as the content view.
5. If you added the fragment statically, get a handle to the fragment.
6. Register the callback.
7. Get a handle to the GoogleMap object.

The Google Maps API is a reliable, easy-to-use, and cost-effective way to add real-time maps to your platform. It can improve user experience and attract new users like the below image,



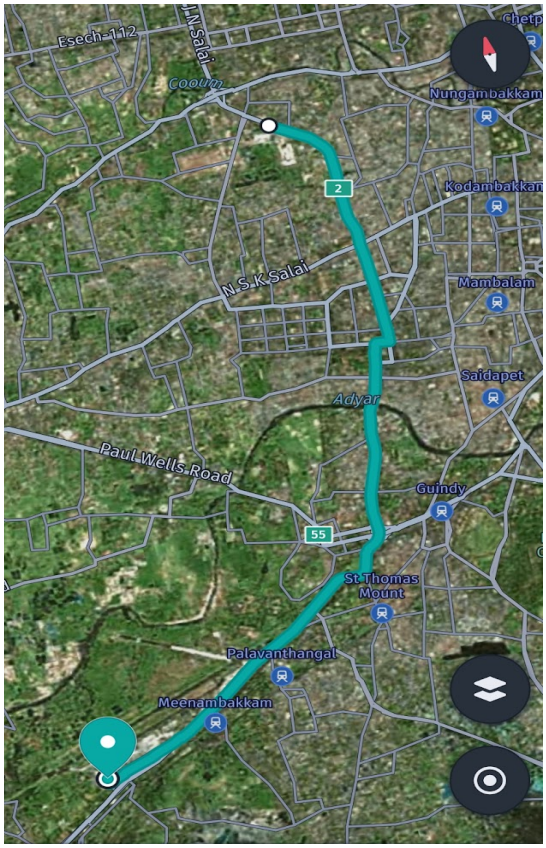
We used this API to implement our ensemble learning with Google Maps objects, which provide real-time map data. This is our application interface.

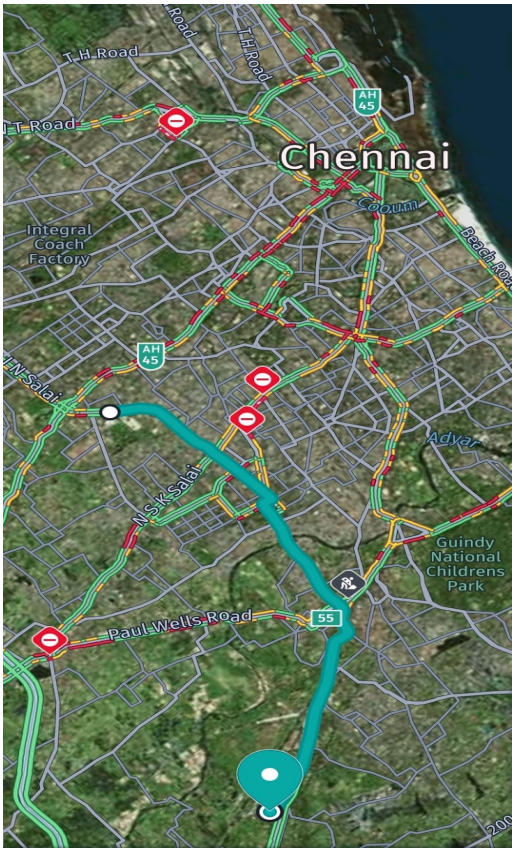
OUR APP INTERFACES :



The images above and below depict the traffic congestion and accident response detected by our platform, with and without the platform's intervention, respectively.

The image above shows a congested traffic situation with a red color indicating heavy traffic and a yellow color indicating moderate traffic. The image below shows a much less congested traffic situation with only a few areas of light traffic.





CONCLUSION

Traffic management is a complex issue, but our solution can help. We are dedicated to developing and implementing our solution to make cities more livable and sustainable. Traffic management involves controlling and managing traffic flow to improve safety and efficiency..

In Phase 4 of the Traffic Information Platform has made significant advancements in data collection, real-time monitoring, route planning, user interface, and user adoption. It is now one of the most comprehensive and reliable sources of traffic information and has been used to improve the lives of travellers around the world.