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# AI-Based Road Accident Risk Prediction and Safer Route Recommendation System for Hyderabad

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***Abstract:*** ***Road accidents are a major safety concern, and travelling through accident-prone areas can increase the risk of road users. This project presents an AI-based Road Accident Risk Prediction and Safe Route Recommendation System that helps users choose routes by considering not only distance and travel time but also accident risk.***
***The system uses historical accident data and geographical information to identify high-risk locations and estimate their risk levels. It displays accident-prone areas on an interactive map and compares the shortest, fastest, and safer routes between a user's current location and destination. During a journey, the system tracks the user's location and provides warnings about relevant high-risk areas along the selected route.***
***By combining accident risk analysis with route recommendations, the proposed system aims to improve road safety awareness and help users make more informed travel decisions. It serves as a supportive navigation tool that encourages safer route choices based on historical accident patterns.***
***Keywords: Road Accident Risk Prediction, Machine Learning, Rule-Based Risk Assessment, Safe Route Recommendation, GPS Tracking, Road Safety.***

## I. INTRODUCTION

Road safety is an important part of our everyday lives. Whether we are travelling to college, going to work, or visiting a new place, we usually choose a route based on how short or fast it is. However, we may not always know whether the roads along the way have a history of frequent accidents. Being aware of such places could help us make better decisions before starting a journey.

To address this problem, our project, AI-Based Road Accident Risk Prediction and Safe Route Recommendation System, aims to help people choose routes by considering not only distance and travel time but also accident risk. The system uses historical accident data and geographical information to identify accident-prone locations and display them on an interactive map. This allows users to see potentially risky areas and better understand the roads they may travel through.

The system provides different route options, including the shortest, fastest, and safer routes, so users can compare them and choose the one that best suits their needs. It also tracks the user's location during the journey and provides warnings about relevant high-risk areas along the selected route. This helps users stay aware of possible risks instead of discovering these locations only after reaching them. Machine learning techniques and rule-based risk assessment can support the identification of accident-prone areas, depending on the implemented prediction model. By bringing together accident risk analysis, route recommendations, map visualization, and location tracking, the project aims to make useful road safety information easier to understand and access.

The goal of this project is not to guarantee a completely accident-free journey, but to help people make more informed travel choices. By highlighting potential risks and providing safer route options, the system can support greater road safety awareness and encourage users to think beyond simply choosing the shortest way to their destination.

## II. LITERATURE SURVEY

Li and Chen [1] proposed a deep-learning approach for traffic accident risk prediction using spatiotemporal features of vehicle trajectories. Their study highlights how vehicle movement patterns and temporal variations can help identify accident-prone locations and improve risk prediction.

Berhanu et al. [2] combined machine learning with spatial network analysis to predict road accidents and support safe route selection. Their work considers accident-prone and congestion-prone road networks, demonstrating the importance of incorporating road risk into route planning rather than relying only on distance or travel time.

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Chai et al. [3] reviewed recent advances in machine learning for road accident prediction using non-visual data. Their study discusses data-driven approaches for improving road safety and identifies challenges and future research directions in accident prediction.

Pei et al. [4] presented an explainable deep-learning framework for predicting road traffic accident risk and identifying key contributing factors. Their work emphasizes the value of interpretable predictions, helping users understand the factors associated with accident risk.

Huang et al. [5] investigated highway risk-event prediction using vehicle trajectory data, traffic flow, and vehicle kinematics. Their approach highlights the importance of combining traffic conditions with vehicle movement characteristics to assess potential risks on highways.

Sohrabi et al. [6] reviewed safe route-finding techniques and future research directions. Their study highlights the limitations of conventional route planning, which primarily focuses on shortest distance or minimum travel time, and emphasizes the need to incorporate road safety into route recommendations.

## III. PROBLEM STATEMENT

When travelling to a destination, people usually choose routes based on distance or travel time without always knowing the accident risks along the way. The shortest or fastest route may pass through accident-prone areas, making it difficult for users to compare routes based on both convenience and safety. SafeRoute AI addresses this problem by using historical accident data and geographical information to identify potentially high-risk locations and assess road risk. Through an interactive map, the system displays accident-prone areas and compares route options based on distance and accident risk. This helps users make more informed route choices and become aware of potential hazards before and during their journey.

### *A. Objectives*

- Predict Accident Risk: Identify accident-prone road locations using AI and historical accident data.
- Recommend Safe Routes: Analyse alternative routes and suggest safer routes by considering accident risk, distance, and travel time.
- Provide Real-Time Risk Alerts: Notify users about high-risk locations along their selected route to support safer travel decisions.

## IV. PROPOSED METHODOLOGY

The proposed methodology for SafeRoute AI: AI-Based Road Accident Risk Prediction and Safe Route Recommendation System aims to help users choose routes by considering both distance and historical accident risk. The system combines historical accident data, machine learning-based risk analysis, geographical mapping, road-network algorithms, GPS tracking, and an interactive map. It focuses on historical accident patterns and geographical information rather than live weather or traffic data.

Initially, historical accident data containing accident locations, frequency, fatalities, and dates is collected along with geographical road-network data for the selected study area. The data is pre-processed by handling missing values, removing duplicate records, and standardizing location information. Geocoding is then used to convert accident locations into latitude and longitude coordinates, allowing the system to display accident points on a map and associate them with nearby roads.

Next, the system identifies accident black spots by analysing accident frequency and severity-related information. Each relevant location or road segment is assigned a risk score from 0 to 100 and classified as Low, Medium, or High risk using predefined thresholds. Machine learning techniques can support risk prediction where implemented, while rule-based assessment helps determine risk from the available accident information. Accident points are matched to nearby road segments, and their risk is propagated to surrounding segments within a defined geographical buffer, such as 1 km, to represent risk across the road network.

The road network is represented as a graph, where intersections are nodes and road segments are edges. Each edge contains distance and risk information, which is used to calculate alternative routes. When a user enters a source and destination, the system calculates the shortest route using distance as the routing cost and a safer route using a risk-aware cost that penalizes high-risk segments. An algorithm such as Dijkstra's can be used for both calculations with different edge weights.

The system then compares the routes using total distance, average risk, maximum risk, and the number of high-risk segments. It also estimates the risk reduction and additional distance associated with the safer alternative. These results are displayed on an interactive map using different colours for each route, along with accident-prone locations and route-risk information. During travel, GPS tracking can identify the user's position relative to the selected route and provide warnings about relevant high-risk areas, based on the available historical risk data.

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Overall, SafeRoute AI integrates accident-data processing, black-spot identification, risk scoring, geographical risk propagation, route optimization, map visualization, and GPS-based alerts into a single system. Its goal is to make historical accident-risk information useful during everyday travel and help users make more informed route choices. The system supports safer decision-making but does not guarantee an accident-free journey.

## V. IMPLEMENTATION

The proposed system, SafeRoute AI, was developed to identify potential road accident risks and support safer route planning using historical accident data, machine learning, and geographical information. The implementation begins with preparing the accident dataset and identifying locations that may have a higher risk of accidents. The prepared data is then used for accident-risk prediction, risk classification, and route assessment. Finally, the results are presented through an interactive map, allowing users to explore routes and consider both travel distance and potential road risks before making a decision.

The complete working process of SafeRoute AI is illustrated in Fig. 01. The flowchart shows the different stages involved in the system, starting with data collection and preprocessing, followed by black spot mapping, risk prediction, and risk classification. The classified risk information is then used for route analysis and safe route recommendation. In the final stage, the results are displayed through a map-based interface, allowing users to view accident-prone locations and compare available routes. This workflow connects accident-data analysis with route planning to help users make more informed travel decisions.

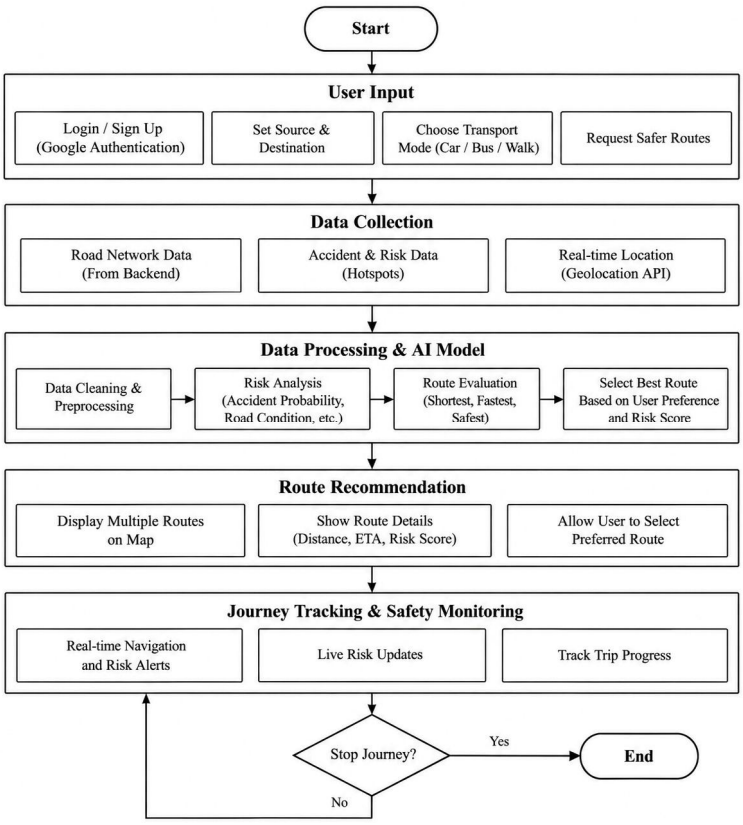



FIG 01: Architecture

The implementation starts with preparing the historical accident-related dataset. The data is organized and processed using Python so that it can be used for risk analysis and prediction. Relevant information, such as accident counts, fatalities, geographical coordinates, and available road details, helps the system understand accident patterns across different locations. During preprocessing, the data is checked for missing values, duplicate records, and inconsistent location information. Predefined scoring criteria are also used to calculate risk scores and classify locations into categories such as LOW, MEDIUM, and HIGH. This prepared information forms the basis for identifying potentially high-risk areas.

| sl_no | location_name | predicted | predicted | predicted | road_name | highway_type | road_leng | road_risk | road_risk | road_type | combined | combined_risk_level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | (Shamshabad) MRO Office Kaman, Shamshabad to Begum's India Garden Function hall | 6.88 | 100 | HIGH | Unknown | residential | 54.8792 | 100 | HIGH | 0.5 | 90 | HIGH |
| 12 | (ESI HOSPITAL / ERRAGADDA) ESI Metro Station to Gokul Theatre | 6.02 | 87.44 | HIGH | Mumbai Highway | trunk | 49.9552 | 87.44 | HIGH | 0.95 | 88.95 | HIGH |
| 17 | (MJ Market) MJ Market to Gandhi Bhavan Road | 5.82 | 84.65 | HIGH | Mukharam Jahi Road | trunk | 170.214 | 84.65 | HIGH | 0.95 | 86.72 | HIGH |
| 40 | Habsiguda X Road ( Street No. 8 to Habsiguda Fire Station | 5.62 | 81.75 | HIGH | Habsiguda Main Road | primary | 72.7251 | 81.75 | HIGH | 0.85 | 82.4 | HIGH |
| 33 | (Ramdevguda Signal) ( Sarvatra sports Complex to Ayurvedic Hospital | 4.77 | 69.32 | HIGH | Unknown | primary | 96.7668 | 69.32 | MEDIUM | 0.85 | 72.46 | HIGH |
| 5 | (ZOO PARK / TADBUN X ROADS) Bahadurpura X Road to Zoo Park | 3.96 | 57.57 | MEDIUM | Flyover | trunk | 791.137 | 57.57 | MEDIUM | 0.95 | 65.06 | MEDIUM |
| 31 | (Bandlaguda X Road) Bandlaguda PS to Highway Restaurent | 4.67 | 67.84 | HIGH | Unknown | residential | 50.5851 | 67.84 | MEDIUM | 0.5 | 64.27 | MEDIUM |
| 7 | (Gaganpahad) Gaganpahad Metro Chas & Carry to AKR Bar | 3.85 | 55.96 | MEDIUM | Unknown | trunk | 13.0157 | 55.96 | MEDIUM | 0.95 | 63.77 | MEDIUM |
| 46 | Masab Tank | 4.48 | 65.08 | HIGH | Chacha Nehru Park Road | residential | 154.889 | 65.08 | MEDIUM | 0.5 | 62.06 | MEDIUM |
| 22 | (MALAKPET GUNJ / CHERMAS) (Malakpet Gunj to PVR Mall | 3.01 | 43.7 | MEDIUM | Vijaywada Highway | trunk | 52.5031 | 43.7 | MEDIUM | 0.95 | 53.96 | MEDIUM |
| 41 | Tarnaka X Road (Tarnaka X Road to habsiguda Fire Station) | 3.1 | 45.05 | MEDIUM | Maula Ali Road | primary | 30.8582 | 45.05 | MEDIUM | 0.85 | 53.04 | MEDIUM |
| 26 | (Bapughat) BAPUGHAT to Tippu Khan Signal | 2.72 | 39.52 | MEDIUM | Unknown | trunk | 832.657 | 39.52 | LOW | 0.95 | 50.62 | MEDIUM |
| 37 | Plaza X Road near Parade Ground (Plaz to SBI X Road) | 2.84 | 41.26 | MEDIUM | Sardar Patel Road | primary | 43.0271 | 41.26 | MEDIUM | 0.85 | 50.01 | MEDIUM |
| 11 | (Thondupally) Indiana Bakery to Masjid E Noori, Shamshabad | 3.31 | 48.08 | MEDIUM | Unknown | residential | 54.8792 | 48.08 | MEDIUM | 0.5 | 48.46 | MEDIUM |
| 20 | (Chaderghat X Road) CHADERGHAT X ROAD to SAI BABA TEMPLE | 2.33 | 33.9 | MEDIUM | Chader Ghat Bridge | trunk | 145.688 | 33.9 | LOW | 0.95 | 46.12 | MEDIUM |
| 14 | (Moosapet) From Super Gas Auto LPG to Metro Piller no. A960 of Sanathnagar | 2.14 | 31.17 | MEDIUM | Sanath Nagar Road | trunk | 75.8741 | 31.17 | LOW | 0.95 | 43.94 | MEDIUM |
| 42 | Mettuguda X Road (Mettuguda metro Station to Alugadda Bavi X Road) | 2.56 | 37.22 | MEDIUM | Unknown | tertiary | 34.473 | 37.22 | LOW | 0.65 | 42.78 | MEDIUM |
| 49 | (TV 9 Office, Rd. No. 3) Indian Oil Petrol Pump to Mountain Bakery | 2.14 | 31.17 | MEDIUM | Road No 3 | primary | 167.459 | 31.17 | LOW | 0.85 | 41.94 | MEDIUM |
| 23 | (MOOSARAMBAGH X ROAD) Moon Bean bar to Captial Hotel | 1.83 | 26.54 | LOW | Vijaywada Highway | trunk | 123.341 | 26.54 | LOW | 0.95 | 40.23 | MEDIUM |
| 21 | (NALGONDA X ROAD) (Nalgonda X Road to Malakpet RUB) | 1.92 | 27.84 | LOW | Sir Louis Flyover | primary | 623.009 | 27.84 | LOW | 0.85 | 39.27 | LOW |
| 13 | (MAITRIVANAM JUNCTION) Maitrivanam Junction to Umesh chandra Statue | 1.72 | 24.98 | LOW | Sanjeeva Reddy Nagar Main Road | trunk | 221.624 | 24.98 | LOW | 0.95 | 38.98 | LOW |
| 29 | (Durga Nagar X Road ) Mailardevpally wines to Durganagar X road | 1.65 | 24.05 | LOW | Inner Ring Road | trunk | 29.9649 | 24.05 | LOW | 0.95 | 38.24 | LOW |
| 38 | Vidaya Nagar X Road (Vidya Nagar X Road to Papaji Dhaba) | 2.37 | 34.49 | MEDIUM | Unknown | secondary_link | 35.3263 | 34.49 | LOW | 0.5 | 37.59 | LOW |
| 2 | (OLD LOVE / BADE MIYA KABAB, UPPER TANKBUND) Yellama Temple to Maqboom Mohiuddin Sta | 1.92 | 27.84 | LOW | Lower Tank Bund Road | secondary | 723.46 | 27.84 | LOW | 0.75 | 37.27 | LOW |
| 43 | Adikmet (Non Teaching Function Hall OU to Ramalayam) | 1.92 | 27.84 | LOW | Osmania University Road | secondary | 1227.36 | 27.84 | LOW | 0.75 | 37.27 | LOW |
| 1 | (CHILDREN PARK, TANKBUND) Alluri Seetharamaju Statue to Komaram Bheem Statue) | 1.56 | 22.69 | LOW | Unknown | trunk | 1699.73 | 22.69 | LOW | 0.95 | 37.15 | LOW |
| 27 | (PVNR Pillar No. 168 to 184) Cinepolis (Upparapally), Royal Colony, Rambagh Colony | 2.01 | 29.27 | LOW | Unknown | tertiary | 239.613 | 29.27 | LOW | 0.65 | 36.42 | LOW |

.FIG 02: Geographical accident-location dataset

The geographical accident-location dataset shown in Fig. 02 contains information about accident locations and their geographical details. Latitude and longitude coordinates help connect accident records to specific places and display potential accident hotspots on a map. By using this information, the system can show where accident-prone areas are located and help users understand the geographical distribution of road risks. These location details also support the route-assessment process by linking accident-risk information to the areas through which a route passes.

| sl_no | zone | police_station | road_no | location_name | total_accidents | total_fatalities | latitude | longitude | coordinate_source | verification |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Secunderabad | Domalguda | NH - 44 (Nagpur to Hyderabad) | (CHILDREN PARK, TANKBUND) Alluri Seetharamaju Statue to Komaram Bheem Statue) | 8 | 4 | 17.42026 | 78.48354 | Google Maps | Verified |
| 2 | Secunderabad | Domalguda | | (OLD LOVE / BADE MIYA KABAB, UPPER TANKBUND) Yellama Temple to Maqboom Mohiuddin Statue | 6 | 6 | 17.41595 | 78.48076 | Google Maps | Verified |
| 3 | Secunderabad | Domalguda | | (LEPAKSHI, UPPER TANKBUND) Pooja Stall to Bade Miya Kabab | 5 | 4 | 17.41188 | 78.48733 | Google Maps | Verified |
| 4 | Rajendranagar | Kamathipura | NH - 44 (Hyderabad to Bangalore) | (PURANAPOOL SHAMSHANGAHT) Puranapool X Road to Bhadurpura X Road | 8 | 7 | 17.36882 | 78.45792 | Google Maps | Verified |
| 5 | Rajendranagar | Bahadurpura | | (ZOO PARK / TADBUN X ROADS) Bahadurpura X Road to Zoo Park | 10 | 10 | 17.35329 | 78.45349 | Google Maps | Verified |
| 6 | Rajendranagar | Rajendranagar | | (BUDVEL RAILWAY STATION ROAD) Budvel Railway Station Road to Starting point of AG College Flyover on NH-44 | 9 | 8 | 17.31116 | 78.42315 | Google Maps | Verified |
| 7 | Shamshabad | RGIA | NH - 44 (Hyderabad to Bangalore) | (Gaganpahad) Gaganpahad Metro Chas & Carry to AKR Bar | 15 | 15 | 17.29422 | 78.41712 | Google Maps | Verified |
| 8 | Shamshabad | RGIA | | (Satamrai) Sri Ramachandra Temple, Shamshabad to RR Convention, Satamrai | 8 | 7 | 17.28111 | 78.4107 | Google Maps | Verified |
| 9 | Shamshabad | RGIA | | (Simplex) Helios Stone - Imported marble - Exotics to ABC Spacery, Satamrai, Shamshabad | 6 | 5 | 17.27561 | 78.40249 | Google Maps | Verified |
| 10 | Shamshabad | RGIA | | (Shamshabad) MRO Office Kaman, Shamshabad to Begum's India Garden Function hall | 21 | 21 | 17.265 | 78.39292 | Google Maps | Verified |
| 11 | Shamshabad | RGIA | | (Thondupally) Indiana Bakery to Masjid E Noori, Shamshabad | 13 | 0 | 17.2669 | 78.39403 | Google Maps | Verified |
| 12 | Jubilee Hills | SR Nagar | | (ESI HOSPITAL / ERRAGADDA) ESI Metro Station to Gokul Theatre | 14 | 6 | 17.45486 | 78.43436 | Google Maps | Verified |
| 13 | Jubilee Hills | SR Nagar | | (MAITRIVANAM JUNCTION) Maitrivanam Junction to Umesh chandra Statue | 5 | 2 | 17.44008 | 78.44251 | Google Maps | Verified |
| 14 | Jubilee Hills | Sanathnagar | NH - 65 (Pune to Hyderabad) | (Moosapet) From Super Gas Auto LPG to Metro Piller no. A960 of Sanathnagar | 5 | 4 | 17.45862 | 78.43295 | Google Maps | Verified |
| 15 | Jubilee Hills | Sanathnagar | | (Bharathnagar) Metro Piller no. A901 to A914, Sanathnagar, Hyderabad | 5 | 5 | 17.46873 | 78.4283 | Google Maps | Verified |
| 16 | Khairathabad | Khairathabad | | OLD PS SAIFABAD TO GLOBAL HOSPITAL, LAKDIKAPOOL | 8 | 5 | 17.40481 | 78.46407 | Google Maps | Verified |
| 17 | Golconda | Begum Bazar | NH - 65 (Hyderabad to Vijaywada) | (MJ Market) MJ Market to Gandhi Bhavan Road | 7 | 3 | 17.38533 | 78.47348 | Google Maps | Verified |
| 18 | Golconda | Afzalgunj | | (Afzalgunj T Junction) AFZALGUNJ T JUNCTION to Shivaji Bridge | 5 | 4 | 17.37494 | 78.48108 | Google Maps | Verified |
| 19 | Golconda | Afzalgunj | | (CBS, Gowliguda) Shivaji Bridge Signal to CBS, GOWLIGUDA | 5 | 3 | 17.37715 | 78.48152 | Google Maps | Verified |
| 20 | Golconda | Afzalgunj | | (Chaderghat X Road) CHADERGHAT X ROAD to SAI BABA TEMPLE | 5 | 2 | 17.38007 | 78.49171 | Google Maps | Verified |
| 21 | Charminar | Chaderghat | | (NALGONDA X ROAD) Nalgonda X Road to Malakpet RUB | 6 | 6 | 17.37575 | 78.49731 | Google Maps | Verified |
| 22 | Charminar | Chaderghat | | (MALAKPET GUNJ / CHERMAS) Malakpet Gunj to PVR Mall | 11 | 10 | 17.37289 | 78.50658 | Google Maps | Verified |
| 23 | Charminar | Malakpet | | (MOOSARAMBAGH X ROAD) Moon Bean bar to Captial Hotel | 7 | 6 | 17.36965 | 78.51559 | Google Maps | Verified |
| 24 | Charminar | Malakpet | | (VAIBHAV BUS STOP / DILSUKH NAGAR) Vibhav Bus Stop to Karthika Hospital | 5 | 4 | 17.3707 | 78.523 | Google Maps | Verified |
| 25 | Rajendranagar | Chandrayangutta | NH- 765 (Chandrayangutta to Srisailam) | (MBNR X ROAD / KESHAVGIRI T JN.) MBNR to Bandalaguda X Road | 8 | 4 | 17.36185 | 78.38628 | Google Maps | Verified |
| 26 | Golconda | Langer House | NH - 163 (Vikrabad to Hyderabad) | (Bapughat) BAPUGHAT to Tippu Khan Signal | 8 | 8 | 17.37316 | 78.40916 | Google Maps | Verified |
| 27 | Rajendranagar | Rajendranagar | Other Road | (PVNR Pillar No. 168 to 184) Cinepolis (Upparapally), Royal Colony, Rambagh Colony | 5 | 4 | 17.35399 | 78.42042 | Google Maps | Verified |
| 28 | Rajendranagar | Rajendranagar | Other Road | (PVNR Pillar No. 138 to 156 ) (Cross road, Hyderguda, Rajendranagar) | 6 | 6 | 17.35938 | 78.42607 | Google Maps | Verified |
| 29 | Rajendranagar | Mailardevpally | Other Road | (Durga Nagar X Road ) Mailardevpally wines to Durganagar X road | 5 | 5 | 17.31436 | 78.44406 | Google Maps | Verified |

FIG 03: Main risk dataset

The main risk dataset shown in Fig. 03 contains the prepared information used for accident-risk analysis and classification. It helps the system organize relevant accident and road-related attributes for identifying locations with different levels of risk. The dataset is used alongside predefined risk-assessment criteria to determine whether a location should be classified as LOW, MEDIUM, or HIGH risk. The resulting information provides the basis for displaying risk levels and identifying potential accident hotspots during route planning. After preparing the datasets, the system uses machine learning models, including Linear Regression, Random Forest, and Gradient Boosting, to estimate accident counts. The models are evaluated to compare their performance, and the resulting predictions support the development of road-risk information. The system combines these predictions with predefined road-risk factors and scoring rules to assess risk levels. This approach brings together data-driven prediction and rule-based assessment to provide a clearer understanding of potential road accident risks. The route-planning component uses geographical road information to evaluate available routes between a selected starting point and destination. Instead of considering only the shortest distance, the system also takes into account the risk information associated with locations along the route.

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This allows users to compare a distance-focused route with an alternative that considers accident risk. The frontend, developed using JavaScript and Leaflet, displays the map, routes, and potential risk hotspots. The Python backend manages data processing and route-related operations, while Firebase supports Google-based user authentication. Estimated travel times for supported transport modes are also provided to help users compare travel options.

Overall, SafeRoute AI brings accident-data processing, machine learning-based prediction, rule-based risk assessment, geographical mapping, and route planning together in one web application. The system aims to make potential road risks easier to understand and helps users consider safety alongside distance and travel time when selecting a route. Although it cannot guarantee an accident-free journey, it provides additional information that can support more informed travel decisions.

## VI. RESULTS

SafeRoute AI combines historical accident data, machine learning, and geographical mapping to identify accident-prone locations and support safer route selection. The processed datasets are used to map accident hotspots and classify locations into LOW, MEDIUM, and HIGH risk categories. The system analyses historical road accident data to identify accident-prone locations and assess their risk levels. Based on accident-related information and predefined risk-assessment rules, locations are classified as LOW, MEDIUM, or HIGH risk. This information is displayed on an interactive map and used during route analysis to help users compare the shortest route with an alternative that considers historical accident risk.

For route recommendation, the system compares the shortest route with an alternative that considers historical accident risk. An interactive map developed using JavaScript and Leaflet displays route options and accident-prone locations, helping users understand the available choices. The Python backend manages data processing and route-related operations, while Firebase supports Google-based user authentication.

Overall, SafeRoute AI helps users consider both distance and historical accident risk when planning a journey. It provides additional information for informed route selection but cannot guarantee an accident-free trip.

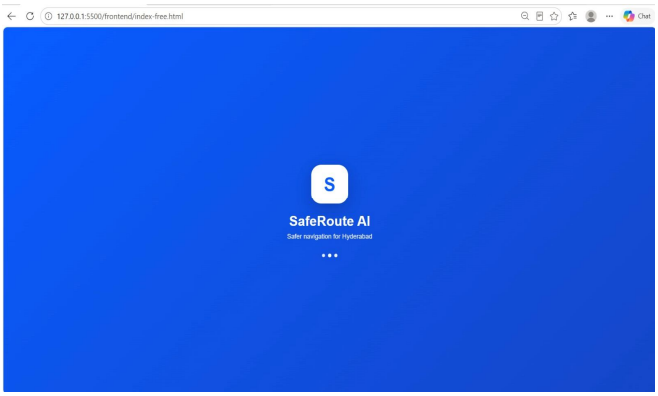



FIG 04: Splash Screen

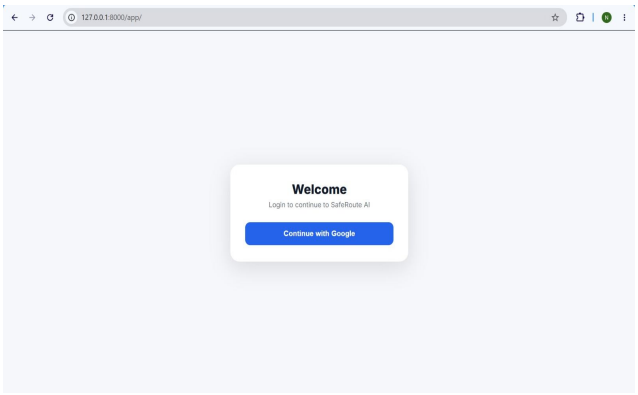



FIG 05: Login Screen

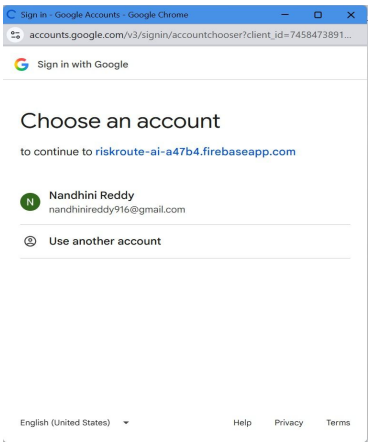



FIG 06: Sign In

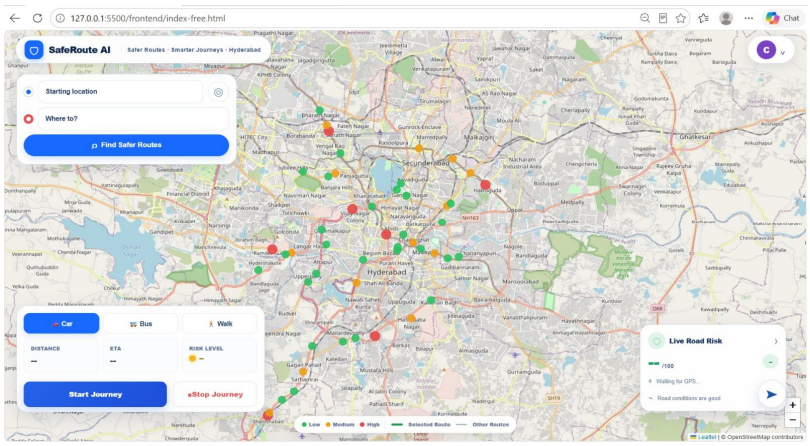



FIG 07: Home Page

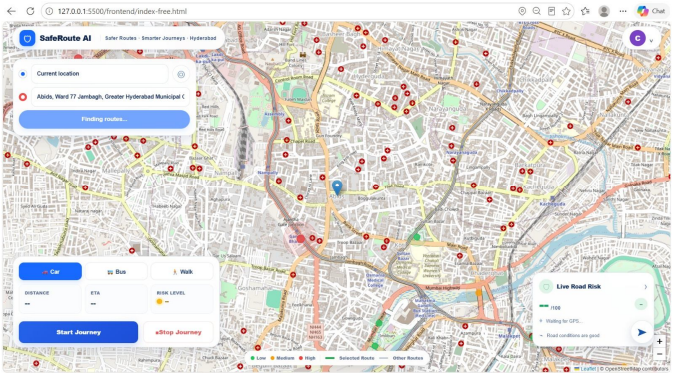



FIG 08: Selecting Starting point and Destination point

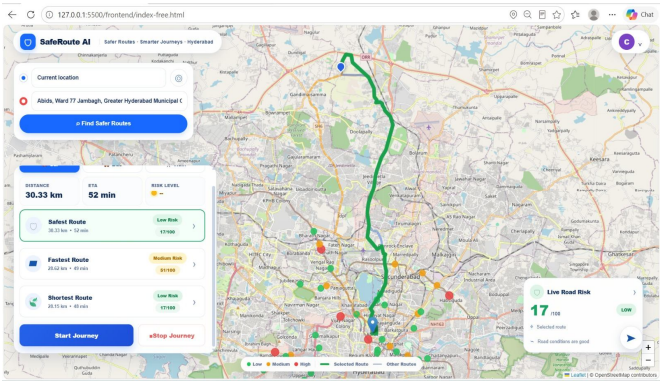



FIG 09: Safer Route

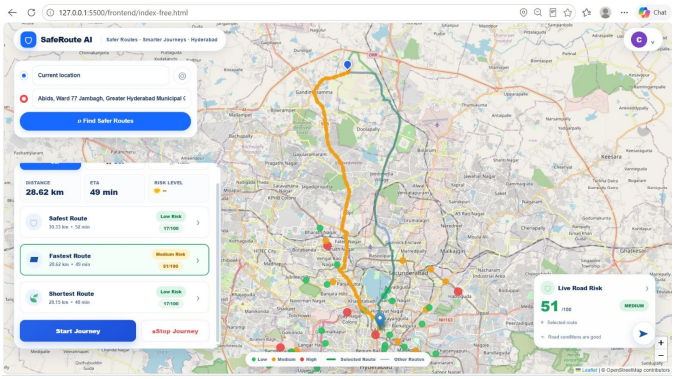



FIG 10: Faster Route

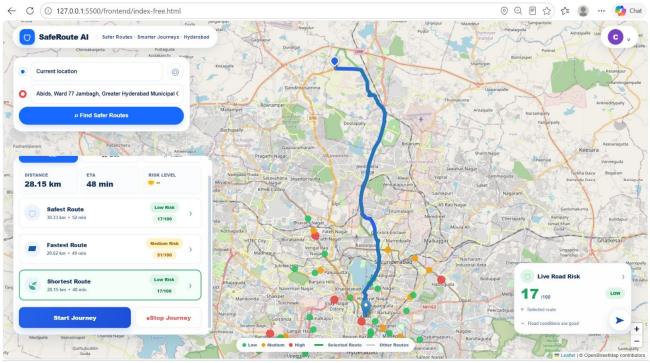



FIG 11: Shorter Route

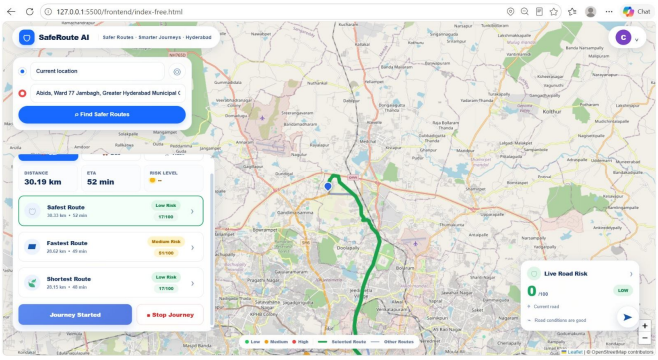



FIG 12: Start Journey

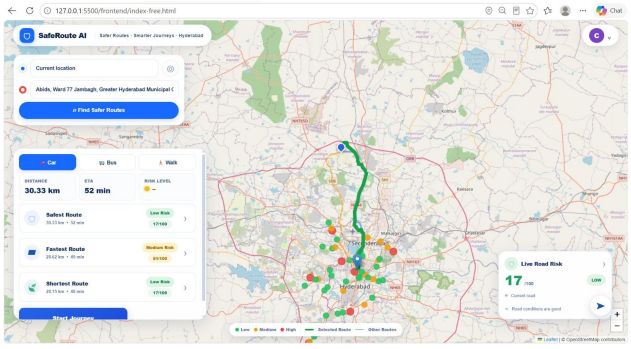



FIG 13: Stop Journey

## VII. FUTURE SCOPE

The future scope of the SafeRoute AI project is to make the system more intelligent, accurate, and useful for real-world road safety. In the future, the application can be expanded to cover more cities and larger road networks, while continuously updating accident and road-risk data from reliable sources. The prediction model can be improved by considering additional factors such as weather, traffic congestion, road conditions, time of day, festivals, construction zones, and historical accident patterns. Real-time traffic and accident information could also be integrated to provide more accurate route recommendations. The system can further include features such as voice-based navigation, emergency alerts, automatic accident detection, SOS support, safer-route recommendations based on personal travel preferences, and detailed journey analytics. With enough real-world data, the AI model could continuously learn and improve its predictions over time. In the long term, SafeRoute AI could be connected with smart-city systems, traffic

authorities, and emergency services to help identify dangerous roads, support faster emergency response, and assist authorities in planning improvements to high-risk locations. Overall, the future goal is to develop SafeRoute AI into a scalable and intelligent road-safety platform that not only helps individual users choose safer routes but also contributes to reducing road accidents and improving transportation safety.

## VIII. CONCLUSION

SafeRoute AI was developed with the aim of making route selection safer and more informed. Instead of choosing a route based only on distance, the system helps users understand the accident risks associated with different locations. By using historical accident data and geographical information, it identifies accident-prone areas, assesses their risk levels, and displays them on an interactive map.

One of the main features of the system is its ability to compare the shortest route with an alternative route that considers historical accident risk. This gives users a better understanding of their available options and helps them choose a route based on both convenience and safety. The map-based interface also makes it easier to view accident hotspots and understand potential risks before starting a journey.

Overall, SafeRoute AI shows how accident data and geographical mapping can be used to support better travel decisions. Although it cannot prevent every accident or guarantee a completely safe journey, it helps users become more aware of accident-prone locations and encourages them to consider road safety when planning their trips. With further improvements and more updated accident data, the system could become even more useful in supporting safer journeys.

## REFERENCES

[1] H. Li and L. Chen, “Traffic accident risk prediction based on deep learning and spatiotemporal features of vehicle trajectories,” PLOS ONE, vol. 20, no. 5, Art. no. e0320656, May 2025. [Online]. Available: https://doi.org/10.1371/journal.pone.0320656

[2] Y. Berhanu, D. Schröder, B. T. Wodajo, and E. Alemayehu, “Machine learning for predictions of road traffic accidents and spatial network analysis for safe routing on accident and congestion-prone road networks,” Results in Engineering, vol. 23, Art. no. 102737, Sep. 2024. [Online]. Available: https://doi.org/10.1016/j.rineng.2024.102737

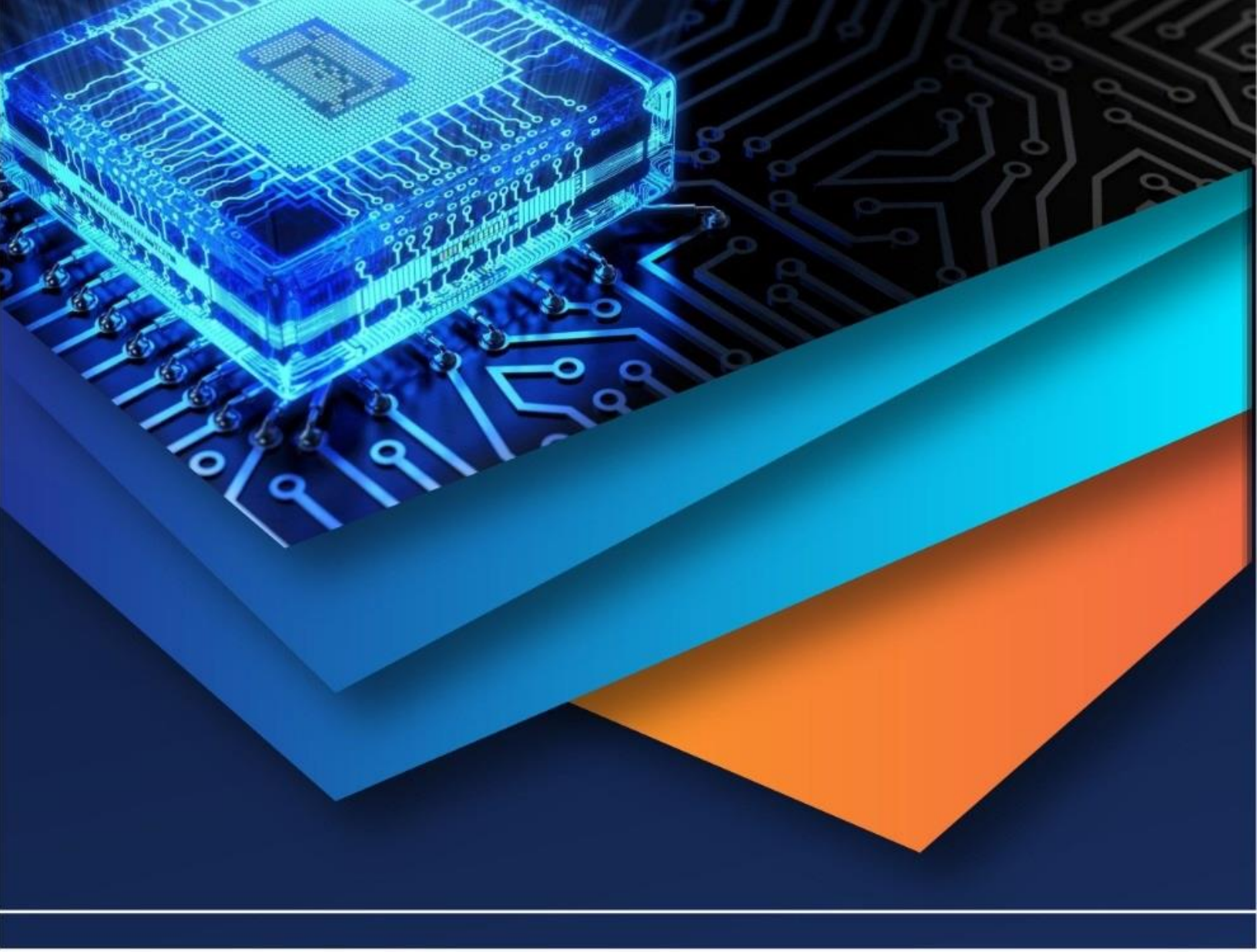
[3] A. B. Z. Chai, B. T. Lau, M. K. T. Tee, and C. McCarthy, “Enhancing road safety with machine learning: Current advances and future directions in accident prediction using non-visual data,” Engineering Applications of Artificial Intelligence, vol. 137, pt. A, Art. no. 109086, Nov. 2024. [Online]. Available: https://doi.org/10.1016/j.engappai.2024.109086

[4] Y. Pei, Y. Wen, and S. Pan, “Road traffic accident risk prediction and key factor identification framework based on explainable deep learning,” IEEE Access, vol. 12, pp. 120597–120611, 2024. [Online]. Available: https://doi.org/10.1109/ACCESS.2024.3451522

[5] S. Huang, H. Chen, X. Wen, and H. Zhang, “Predicting highway risk event with trajectory data: A joint approach of traffic flow and vehicle kinematics,” Electronics, vol. 13, no. 3, Art. no. 625, Feb. 2024. [Online]. Available: https://doi.org/10.3390/electronics13030625

[6] Soheil Sohrabi, Yanmo Weng, Subasish Das, and Stephanie German Paal, “Safe route-finding: A review of literature and future directions,” Accident Analysis & Prevention, vol. 177, Art. no. 106816, Nov. 2022. [Online]. Available: https://doi.org/10.1016/j.aap.2022.106816

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