



Karnataka State Police
Government of Karnataka

ATATHON 2024

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Idea Brief :

Our comprehensive solution harnesses cutting-edge technologies to address the various aspects outlined in the expected solution. Central to our approach is the implementation of a dynamic live dashboard, leveraging Power-BI or Tableau, to provide real-time insights into critical road safety metrics. Our predictive analysis model, powered by advanced classification and recommendation algorithms, allow us to identify black spots of accidents and predict future grey spots. Additionally, these models analyze the date, time, and location of accidents to predict their probability and pinpoint potential accident hotspots on different road types. Our system delves into the contributing factors for multiple injuries and fatalities, including analysis of landmarks near accidents, road signages, road conditions, and pedestrian behaviors. We also analyze the types of vehicles involved in accidents and predict accident zones based on their characteristics. Our model consider the profiles of accused and victims, including gender, age, and behavior, to understand underlying patterns. To build a comprehensive analysis model, we superimpose all causative and contributing factors, correlating them with traffic deployment and enforcement strategies. Our AI model learns from past accidents to predict future occurrences and suggest optimized traffic deployment plans. Real-time notifications, driven by live data feeds, keep drivers informed about accidents, weather changes, and road conditions, enhancing situational awareness. Additionally, our system utilizes computer vision technology to detect driver behaviors like helmet and seatbelt usage, ensuring adherence to safety regulations. To engage and educate drivers, we deploy a chatbot fueled by large language models, offering personalized guidance on road safety practices. Furthermore, our integrated gamified safety system incentivizes responsible driving behavior through personalized safety scores and friendly competitions, fostering a culture of safety among drivers. By seamlessly integrating AI algorithms and machine learning model, our holistic approach aims to elevate road safety awareness and mitigate the occurrence of accidents, thus contributing to safer roads and communities.



Tech Stack Used

Dedicated Live Dashboard:

- Frontend: HTML/CSS, JavaScript, React.js or Angular
- Backend: Node.js, Express.js
- Data Visualization: PowerBI or Tableau for real-time dashboarding

Predictive Analysis Model:

- Machine Learning Framework: Python, TensorFlow, or PyTorch for building predictive models
- Data Processing: Pandas, NumPy
- Deployment: Docker, Kubernetes for containerization and scaling

Real-time Notifications:

- Backend: Node.js, Express.js for handling real-time data streams
- Messaging Queue: Apache Kafka or RabbitMQ for managing message queues
- Integration: RESTful APIs, Websockets for real-time communication

Computer Vision for Driver Behavior Detection:

- Computer Vision Framework: OpenCV for image processing
- Machine Learning Framework: TensorFlow Object Detection API for training models
- Deployment: Docker, Kubernetes for deploying and managing computer vision services



Tech Stack Used

LLM-powered Chatbot:

- Natural Language Processing Framework: Python, spaCy, NLTK for language processing
- Chatbot Platform: Dialogflow, Rasa for building conversational interfaces
- Large Language Model: OpenAI's GPT (Generative Pre-trained Transformer) models for advanced chatbot capabilities
- Deployment: Cloud platforms like Google Cloud Platform or AWS for hosting chatbot services

Integrated Gamified Safety System:

- Backend: Node.js, Express.js for handling user interactions and scoring
- Database: MongoDB or PostgreSQL for storing user data and scores
- Frontend: HTML/CSS, JavaScript, React.js or Angular for building the user interface

Infrastructure and Deployment:

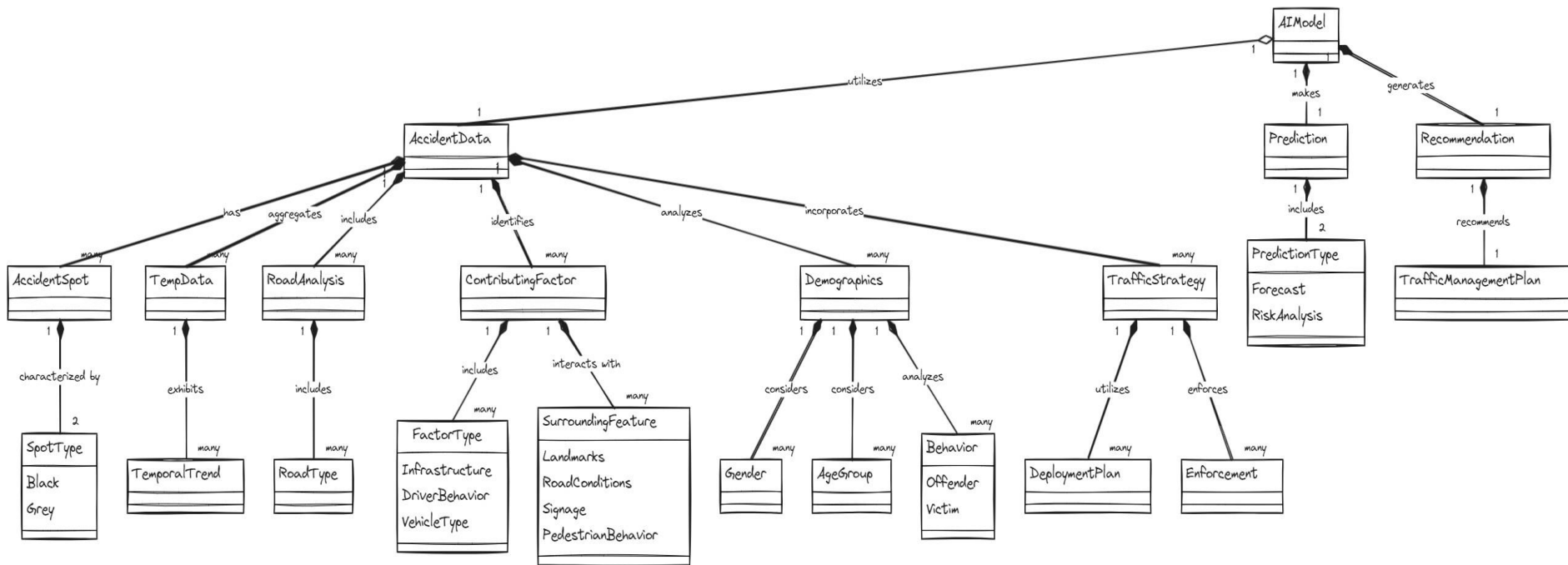
- Cloud Platforms: AWS, Google Cloud Platform, or Microsoft Azure for hosting services
- Containerization: Docker for packaging applications
- Orchestration: Kubernetes for managing containerized applications
- Monitoring and Logging: Prometheus, Grafana, ELK Stack for monitoring and logging system health

Additional Components:

- **LLM2:** Incorporate OpenAI's next-generation large language models for enhanced chatbot capabilities and natural language understanding.
- **OpenAPI:** Utilize OpenAPI specifications for defining RESTful APIs, promoting interoperability and standardization across services.
- **RAG Technology:** Integrate RAG (Retrieval-Augmented Generation) technology for improved chatbot responses by combining the benefits of both retrieval and generative models.



Architecture Design





Positive and Unique Solutions

1. Dedicated live dashboard:

Utilizing PowerBI or Tableau for a live dashboard is a great idea. Make sure the dashboard is user-friendly, visually appealing, and provides real-time insights into key metrics related to road safety.

2. Predictive analysis model:

Building predictive models, especially combining classification and recommendation models, can provide valuable insights into potential accident hotspots, driver behavior patterns, and personalized recommendations for safer driving practices. Ensure that the models are robustly trained and validated with accurate data.

3. Real-time notifications:

Incorporating real-time notifications and suggestions about accidents, weather changes, road conditions, and speed limits can significantly enhance driver awareness and safety. Integrating with APIs or sensors for live data feeds will be crucial for the accuracy and timeliness of these notifications.



Positive and Unique Solutions

4.Computer vision for driver behavior detection:

Using computer vision to detect whether drivers are wearing helmets, seatbelts, or driving in the wrong direction can be a powerful tool for enforcing road safety regulations. However, ensure that privacy concerns are addressed and that the system is accurate and reliable in various environmental conditions, locate events of interest or defects in infrastructure, assets, and roadways.

5.LLM-powered chatbot for road safety awareness:

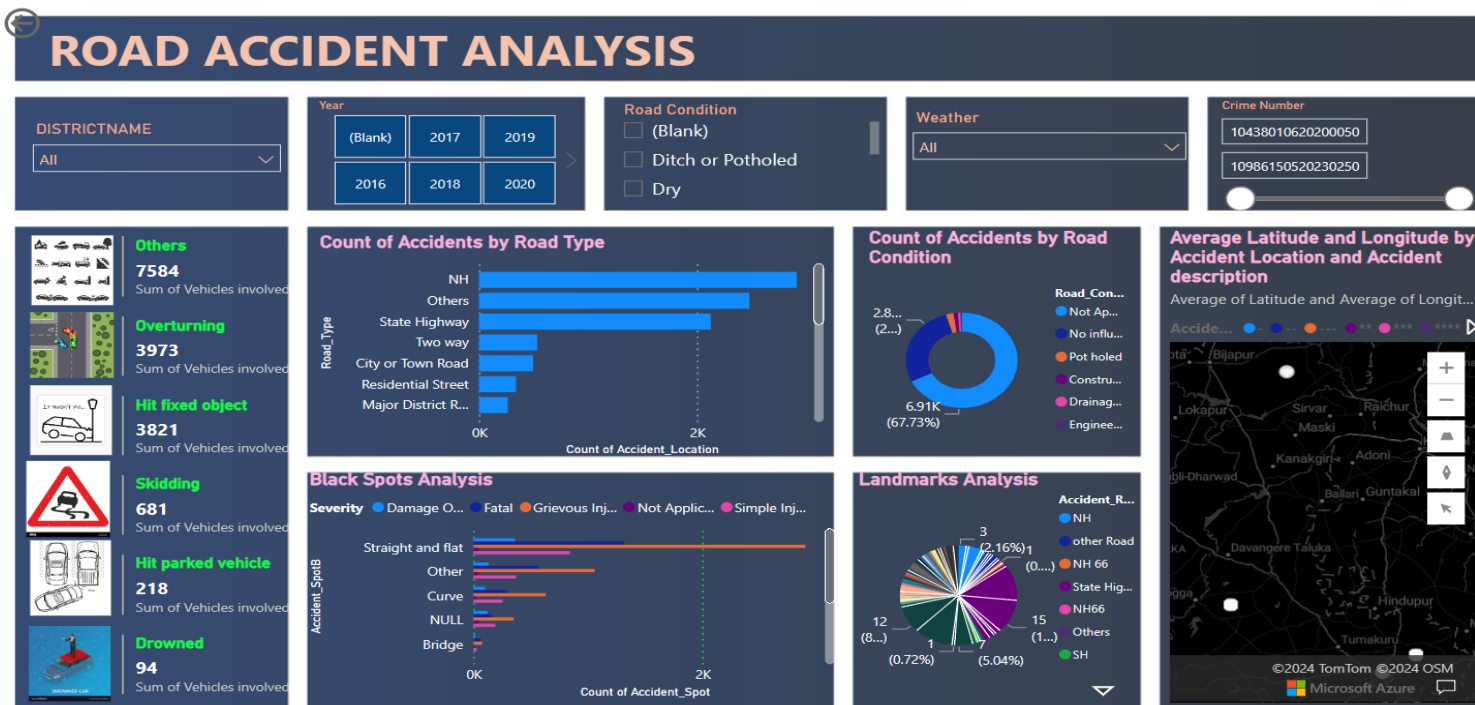
Building a chatbot powered by large language models (LLMs) to educate drivers about road accidents, traffic rules, and driver responsibilities is a creative and effective way to raise awareness. Ensure that the chatbot is interactive, engaging, and capable of providing personalized information and guidance.

6.Integrated Gamified Safety System :

Develop an integrated system that gamifies safe driving practices while providing personalized safety scores. Users earn points or badges for adhering to speed limits, wearing seatbelts, and following traffic rules, which contribute to their personalized safety score. Leaderboards and competitions foster friendly competition among drivers. Regular reports offer insights into individual driving habits and provide personalized recommendations for improvement, enhancing overall road safety awareness and incentivizing responsible driving behavior.

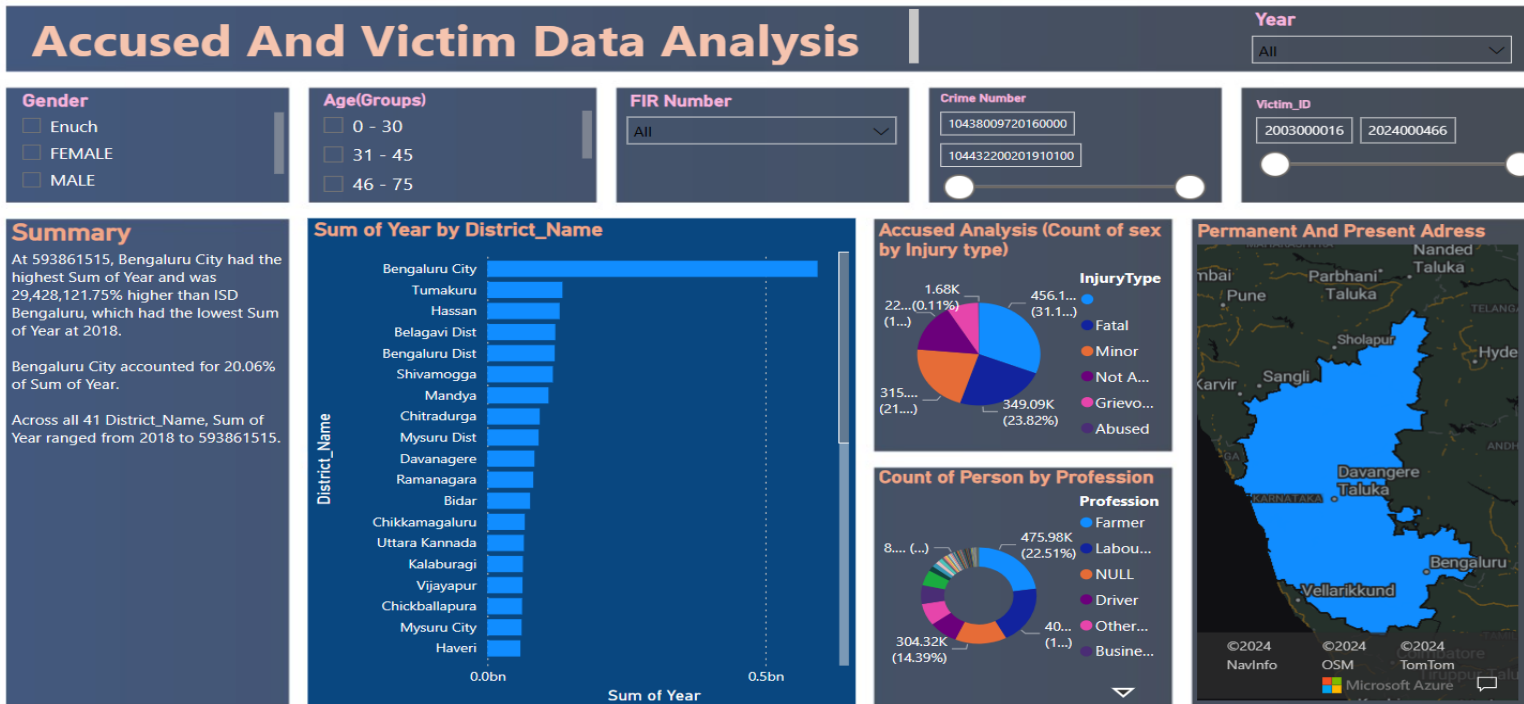


SOLUTION



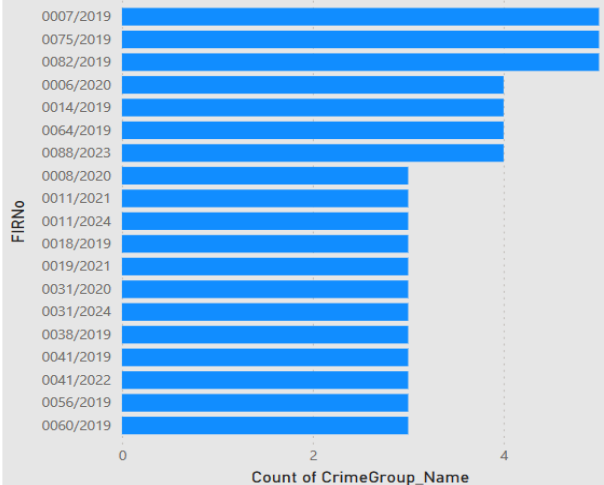


SUMMARY

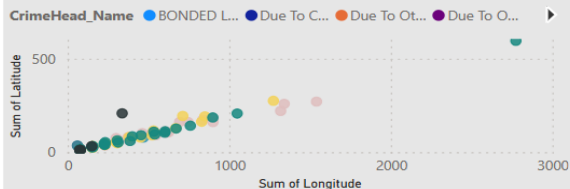




Count of CrimeGroup_Name by FIRNo

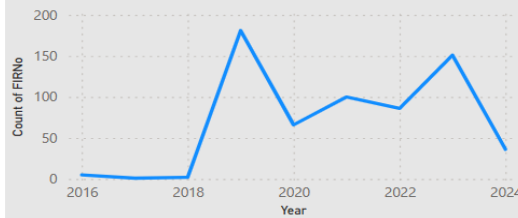


Sum of Longitude and Sum of Latitude by District_Name and CrimeHead_Name

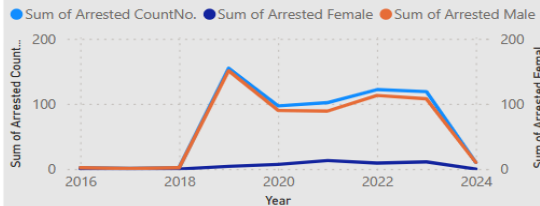


Analyzing Road Accident Trends through FIR Data

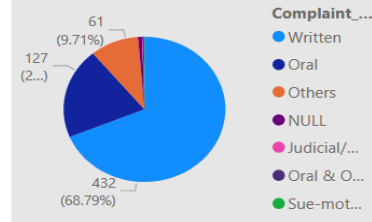
Count of FIRNo by Year



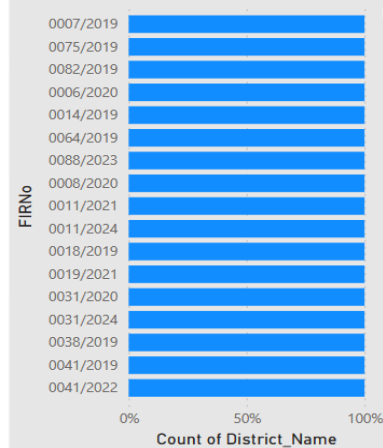
Sum of Arrested CountNo., Sum of Arrested Female and Sum of Arrested Male by Year



Count of FIRNo by Complaint_Mode



Count of District_Name by FIRNo





Queribot



Preparing Q&A



8:21:56 pm

PREDICTION

Main_Cause

Human Error

RI

RoadJunction

Probability Main_Cause is Hum...

55.46%

Probability Main_Cause is Not ...

33.76%

Probability Main_Cause is Vehi...

10.59%

Probability Main_Cause is Road...

0.16%

Probability Main_Cause is BUD...

0.01%

Probability Main_Cause is Acci...

0.01%

OTHER MODELS TESTED

Model Type	Trial	Training Loss	Training Accuracy	Validation Loss	Validation Accuracy
Multilayer Neural Network	--	0.007654	82.57%	0.031106	82.59%
Linear Regression	--	0.000349	80.18%	0.000313	83.15%