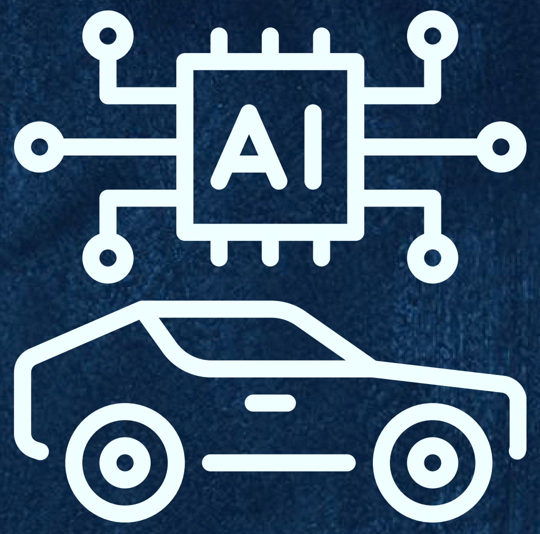
AI POWERED PREDICTIVE MAINTAINENCE FOR OEM'S



Problem Statement: Reactive or scheduled Vehicle Maintenance - Inefficient and Costly

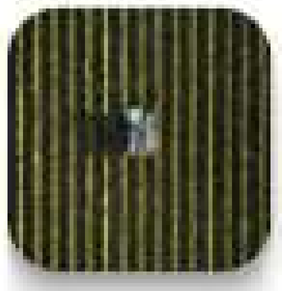
SOLUTION

An AI-powered system that leverages Machine Learning Algorithms and IoT sensors to predict vehicle failures and provide actionable insights for proactive maintenance implementation of solution with fleet management system and Advanced machine learning operations

AI-POWERED PREDICTIVE MAINTENANCE FOR OEMS

TRANSFORMING VEHICLE MAINTENANCE WITH AI AND IOT

ADVANTAGES OF AI-PPMS FOR OEM"S AND VEHICLES



Overview of Predictive Maintenance

Introduction to systems that enhance vehicle health through AI.

Monitoring Vehicle Health

Systems continuously track vehicle conditions to predict issues and failures.

Optimized Maintenance Scheduling

Real-time data informs better scheduling for maintenance.

Reducing Downtime

Effective prediction leads to less downtime for fleets.

Benefits for Fleet Efficiency

Improved management reduces unexpected breakdowns and costs.

Insights for Design Improvements

Data reveals recurring issues aiding better vehicle design.

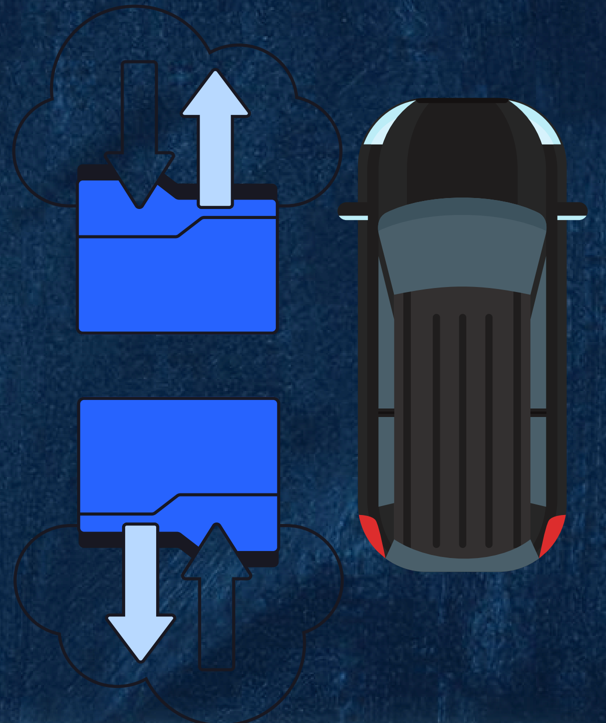
KEY FEATURES

WORK FLOW - PHASES

Key feature	Phase	Description
Realtime-Data collection	PHASE - 1	Data collection with fleet app, Sending the collected data to cloud with cloud application
Machine learning algorithms	PHASE - 2	Processing data , Model Training, Model Evaluation, Model Optimization and Model deployment
Cloud management	PHASE - 3	Getting data to cloud, datapipeline to Trained ML Model and getting predictions
Mobile App or Dash board	PHASE - 4	Sending predictions as notifications to drivers mobile app, Updating the cloud based dashboard and collecting data for OEM’s

PHASE - 1

REAL-TIME VEHICLE DATA COLLECTION WITH FLEET MANAGEMENT SYSTEM



In Phase 1, the work will focus on collecting data from the vehicle and processing to the cloud in various ways which are described in below.

USING GPS/TELEMATICS

- Having GPS and telematics devices on each vehicle in the fleet. These devices will collect data like location, speed, fuel level, engine health, and other key performance indicators.
- Ensuring these devices have connectivity capabilities, like cellular (4G/5G) or satellite, for real-time data transmission.

IOT SENSORS

- vehicles with IoT sensors for parameters like tire pressure, temperature, fuel consumption, and driver behavior. This data can be useful for optimizing maintenance and enhancing driver safety.
- These sensors should integrate with the telematics device to send data to a centralized system.

DATA TRANSMISSION

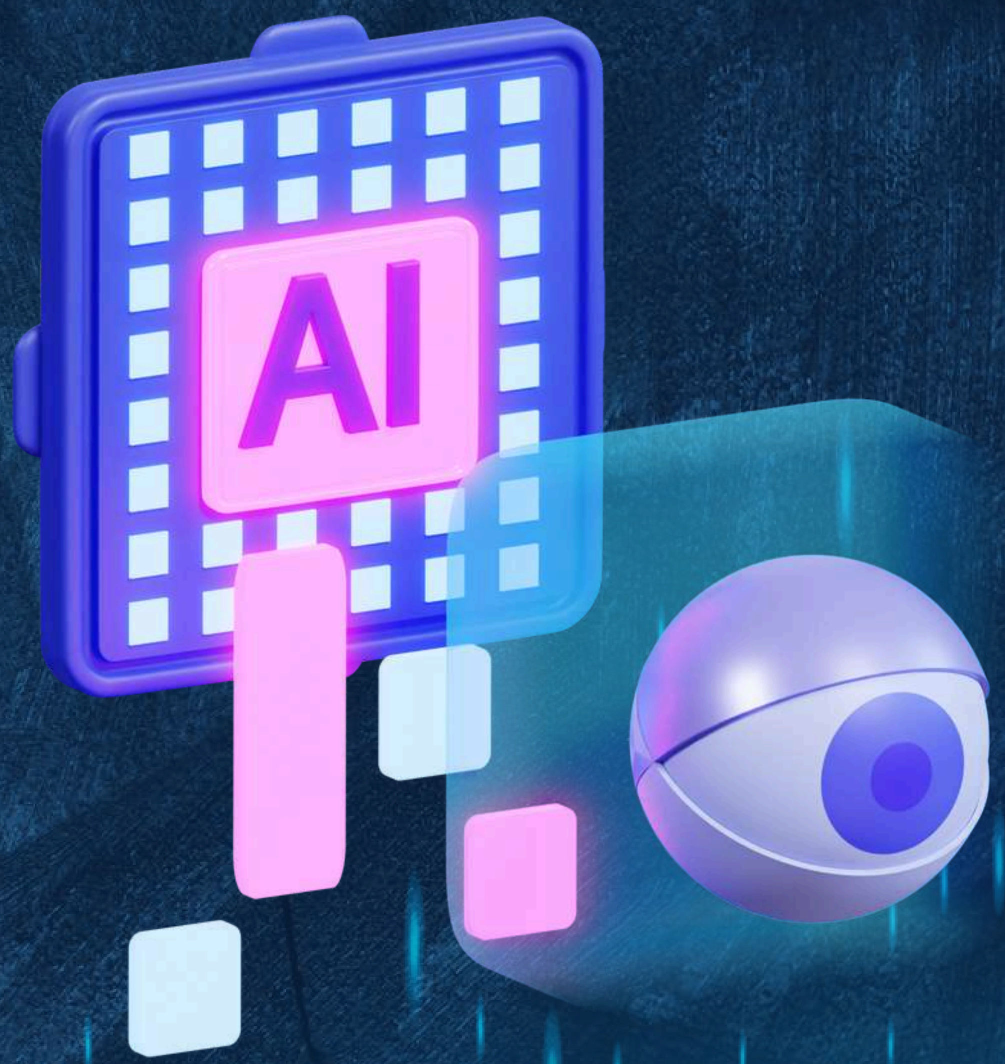
- Setting up a secure network or cloud storage to receive and store the data from fleet. A cloud platform like AWS, Azure, or GCP can manage and store large volumes of data effectively.
- Choosing real-time data transfer protocols, such as MQTT (for IoT devices) or HTTPS, to securely transmit data from vehicles to server.

PHASE – 2

MACHINE LEARNING

In this stage, we utilize real-time data to process and train the model using various algorithms. Once the model is trained, we evaluate its performance to ensure accuracy and effectiveness as the below steps.

1. **Data Processing and Preparation**
   - Collecting and cleaning data.
   - Engineering features to enhance model predictiveness.
2. **Model Training**
   - Training models using various algorithms and optimizing with hyperparameter tuning.
   - Selecting the best-performing algorithm.
3. Model Evaluation
   - Testing and validating models based on accuracy and consistency.
   - Choosing the most accurate and efficient model.
4. Model Optimization
   - Fine-tuning for better performance and avoid overfitting.
   - Streamlining model for real-time processing efficiency.
5. Cloud Deployment
   - Deploying the optimized model in the cloud for scalability.
   - Setting up a real-time prediction pipeline and monitor performance.



PHASE – 3 CLOUD MANAGEMENT

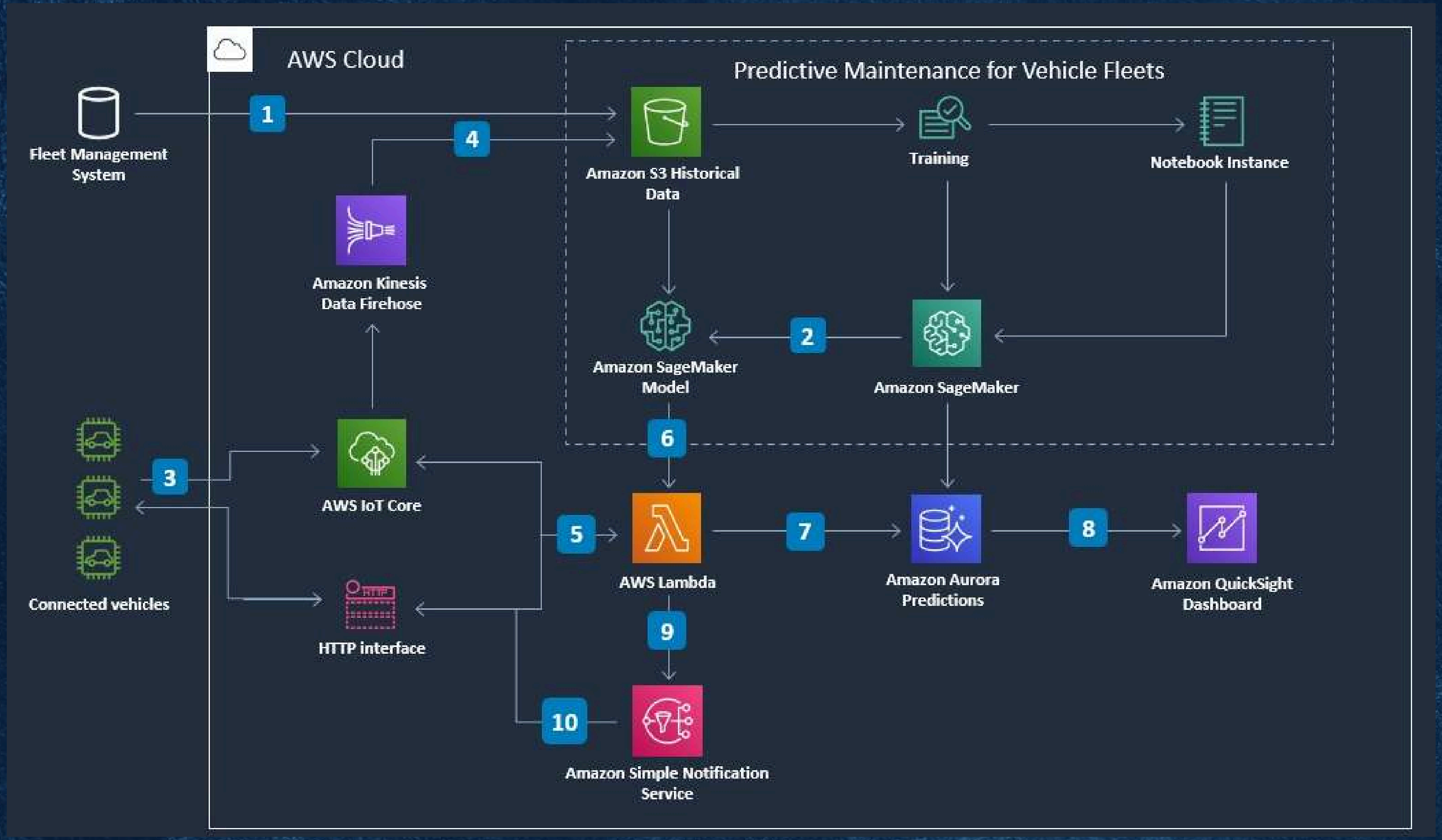
1. Data Collection & Pipeline
   - Real-Time Ingestion: Continuous data from IoT sensors stored in the cloud.
   - Automated Pipeline: Cleans, transforms, and stores data in real time.
2. Data Processing
   - Scalable Power: Handles large data volumes efficiently.
   - Stream & Batch Processing: Supports real-time and historical data analysis.
3. Model Training & Prediction
   - ML Tools: Cloud platforms enable high-performance model training.
   - Real-Time Predictions: Deployed models deliver timely maintenance alerts.
4. Continuous Deployment
   - Seamless Updates: CI/CD pipelines for model retraining.
   - Scalability: Adapts to data flow changes, ensuring consistent service.

Cloud processing enables predictive maintenance with accurate, real-time insights for proactive maintenance actions there are many cloud platforms that provides all the features that are required for predictive maintainence .

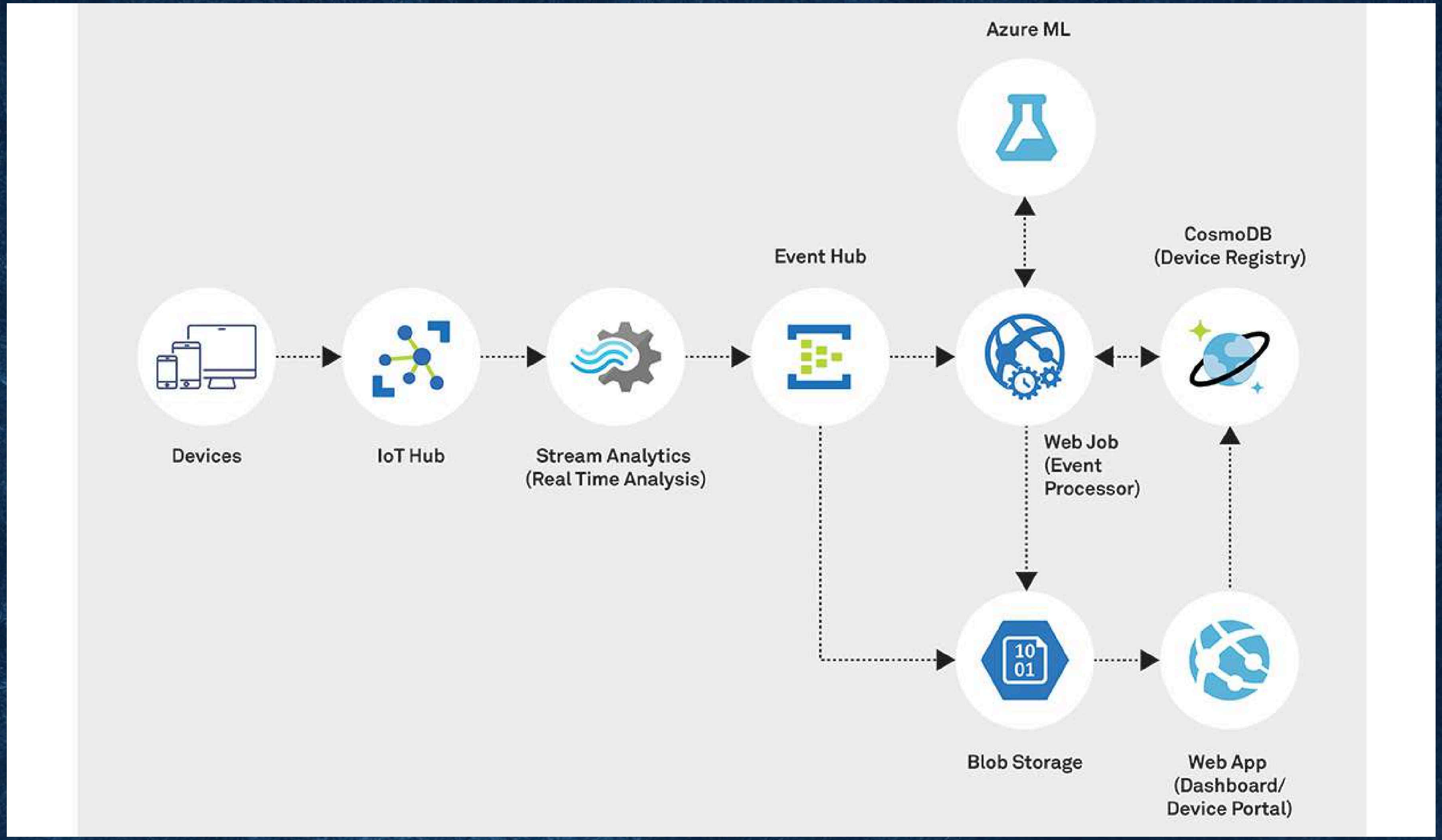
Azure

REQUIRED CLOUD ARCHITECTURE FOR PROJECT

THERE ARE VARIOUS PLATFORMS THAT PROVIDE CLOUD SERVICES, IN PROJECT PROTOTYPE WE USED MICROSOFT AZURE .



AWS ARCHITECTURE FOR PREDICTIVE MAINTAINENCE



MICROSOFT AZURE ARCHITECTURE FOR PREDICTIVE MAINTAINENCE

PHASE – 4 CLOUD BASED MOBILE APP / DASHBOARD

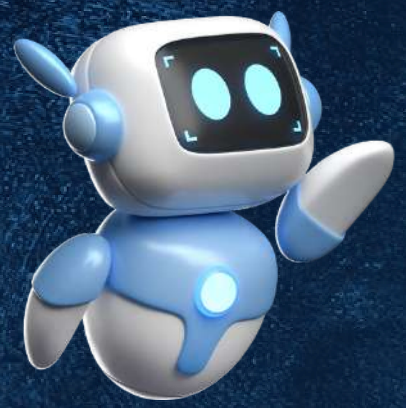
A real-time cloud dashboard that visualizes data and sends maintenance alerts to the driver app as mobile notifications. The data is stored by OEMs, allowing them to use it for performance improvements.

The mobile app for the predictive maintenance system provides real-time alerts and notifications to drivers about vehicle health and upcoming maintenance needs. It connects to the cloud dashboard, allowing drivers to monitor key performance indicators, receive predictive maintenance alerts, and access essential vehicle data. This proactive approach helps prevent unexpected breakdowns and enhances vehicle safety and reliability.

PROTOTYPE

Finally, regarding the prototype we created for this hackathon...

- This is a major project that requires significant time to complete. However, within the limited time available for creating an MVP, we managed to accomplish some crucial aspects of the project
- The crucial work that represents our prototype includes creating a data pipeline in the cloud, organizing and analyzing the data to assess how the vehicle data aligns, and working through the data science process.
  - We created resources in the Azure cloud and documented the resource creation commands in YAML files, which are included in the submitted GitHub repository.
  - We incorporated our data science work into the prototype, including data cleaning, visualization, model training, and model evaluation.
  - We trained various models using different algorithms, each achieving good evaluation metrics and scores. However, to further improve the scores significantly, we need to generate the required transformers and apply other optimization techniques, which require additional time and are therefore included in the future work.
  - All the cloud resource generation commands, data science process files, and dashboard generation files have been uploaded to the submitted GitHub repository.



THANK YOU!

All the cloud resource generation commands, data science process files, and dashboard generation files have been uploaded to the submitted GitHub repository as for the prototype link is given below.

CLICK HERE

We hereby declare that the work presented in this project is the result of our genuine effort during the imobilothon 4.0. All components, including the cloud resource generation, data science processes, and dashboard generation, were developed and implemented by us. We have documented all relevant files, including resource creation commands, data cleaning, visualization, model training, and evaluation steps, and have uploaded them to the submitted GitHub repository. This prototype reflects the progress achieved within the given timeframe, with additional work planned for future development.