



# ***SPACE DEBRIS & WEATHER PREDICTION PLATFORM***



# **PROBLEM STATEMENT**

- **As space becomes more crowded with satellites and debris, the risk of collisions and disruptions from unpredictable space weather grows.**
- **Existing tools for tracking debris and predicting space weather are disconnected, makes high chance of collision and disruption.**
- **There's a need for a unified platform that combines debris tracking, collision warnings, and space weather forecasts, providing timely alerts and essential information to ensure safe space operations.**



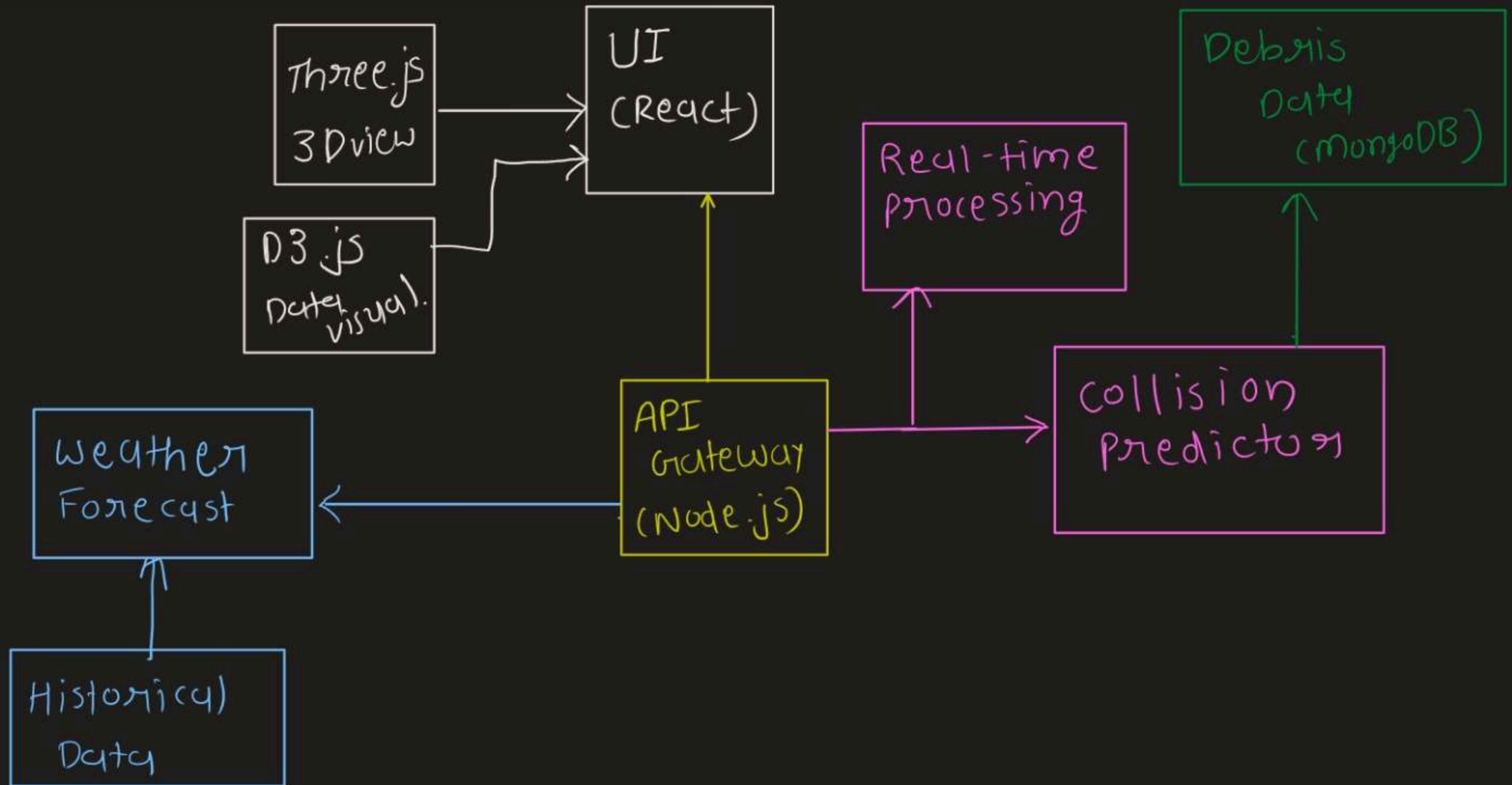


# **SOLUTION**

- **To address the challenges of space debris and unpredictable space weather, we can build an integrated platform that brings everything together in one place.**
- **This platform would track space debris in real-time, predict potential collisions, and forecast space weather events.**
- **By combining all these features, it would provide timely alerts and clear information, making it easier for space operators to make quick decisions and avoid accidents.**
- **This<sup>2</sup> unified approach would improve coordination, reduce risks, and ensure that space missions, satellites, and other operations are conducted safely and efficiently.**



# FLOW CHART OVERVIEW





# FRONTEND

- **User Interface:**

This is where users interact with the platform. The UI is built using React.js, which provides a responsive and interactive experience.

- **Connected to:**

The API Gateway (Node.js) to fetch data and interact with backend services.

The 3D Visualization (Three.js) and Data Visualization (D3.js) modules for displaying real-time data visually.





# **FRONTEND**

- **3D Visualization (Three.js):**

Responsible for rendering 3D models, such as the paths of space debris, so users can visualize orbits and potential collisions.

The User Interface (React.js) to display the 3D visualizations directly in the frontend.

- **Data Visualization (D3.js):**

Used for creating advanced charts and graphs, such as space weather forecasts and historical data trends.

The User Interface (React.js) to embed these visualizations within the main user interface.



# **BACKEND**

- **API Gateway (Node.js):**

**Serves as the central hub for communication between the frontend and backend services.**

- **Connected to:**

**The User Interface (React.js) for handling requests from the frontend.**

**The Real-Time Processing (Kafka), Collision Prediction (Python), and Space Weather Forecasting (Python) modules to distribute and manage backend tasks.**

- **Real-Time Processing (Kafka):**

**Manages the continuous flow of space debris data, ensuring real-time processing and updates.**

**The API Gateway (Node.js) to receive and send data.**

**The Space Debris Data (MongoDB) database to store the processed real-time data.**



# **BACKEND**

- **Collision Prediction (Python):**

Utilizes algorithms to predict potential collisions based on the trajectory data received.

- **Connected to:**

The API Gateway (Node.js) to receive trajectory data.

The Space Debris Data (MongoDB) database to store collision predictions.

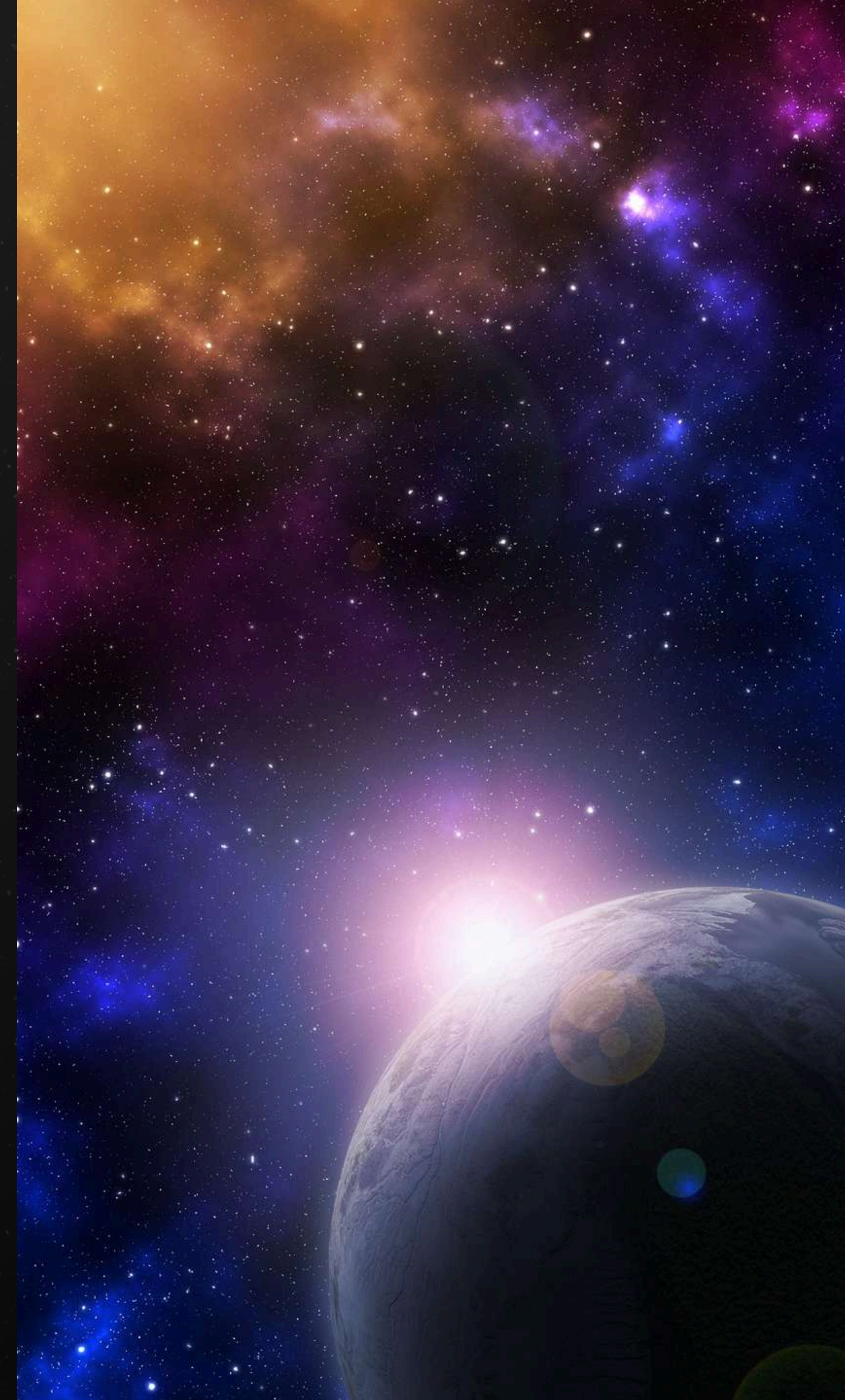
- **Space Weather Forecasting (Python):**

Analyzes space weather data and predicts potential events that could affect satellites and missions.

- **Connected to:**

The API Gateway (Node.js) for accessing data.

The Historical Data (PostgreSQL) database for storing and retrieving historical weather data.





# **DATABASE**

- **Space Debris Data (MongoDB):**

**Stores real-time and historical data on space debris, including position, velocity, and collision predictions.**

- **Connected to:**

**The Real-Time Processing (Kafka) for real-time data storage.**

**The Collision Prediction (Python) for storing predicted collision data.**

- **Historical Data (PostgreSQL):**

**Stores historical records of space weather, which are used to improve the accuracy of space weather forecasting.**

- **Connected to:**

**The Space Weather Forecasting (Python) module for accessing and updating historical data.**



A wide-angle view of Earth from space, showing the curvature of the planet and a dense layer of white clouds. A bright light source, likely the sun, is positioned directly behind the horizon line, creating a strong lens flare and illuminating the scene from above.

***THANK YOU***

***PRIYANK  
AYUSH  
RAJ  
NIRMAL***