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BAHRIA UNIVERSITY KARACHI CAMPUS

**Department of Software Engineering**

**COURSE: CSL 220**

**CLOUD COMPUTING**

**PROJECT Proposal**

**CLASS: BSE – 6 C (SPRING - 2025)**

Orrery Web App

(Real-Time Solar System and NEO Visualization)

**Group Members**

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**Date: 24/04/2025**

# **Introduction & Background**

The study of celestial bodies and their movements has fascinated humanity for centuries. With advancements in technology, we now have the ability to visualize and understand the behavior of solar system objects in an interactive and dynamic way. This project focuses on creating a web application that provides a detailed, real-time view of the solar system and Near-Earth Objects (NEOs). By visualizing planetary movements, asteroids, and comets, the project aims to provide an educational platform for users to explore our solar system and its dynamic components.

# **2. Problem Statement**

Current educational tools that display solar system data are often static, outdated, or lack interactivity. There is a need for a platform that offers real-time, interactive visualization of celestial bodies, allowing users to gain a deeper understanding of their movements and trajectories. This project addresses the challenge of providing an engaging, user-friendly experience with up-to-date information on NEOs and planetary data.

# **3. Proposed Solution**

This project proposes the development of an interactive orrery web application that visualizes the solar system and Near-Earth Objects (NEOs) in real time. The app will allow users to interactively explore the solar system, observe the positions, orbits, and movements of celestial bodies. It will leverage Firebase for data storage, ensure user security through Firebase Authentication, and continuously update data using external APIs. The project will integrate these technologies to create a dynamic, engaging, and educational platform.

**3.1 Features of the Project**

The application will offer the following key features:

* **Real-time Visualization**: A dynamic, interactive orrery model showcasing the solar system, with real-time updates for NEOs and planetary positions.
* **Interactive Model**: Users can zoom in, zoom out, and navigate through the solar system to focus on specific celestial bodies such as planets and asteroids.
* **User Authentication**: Secure login and access through Firebase Authentication, allowing users to create accounts and track their preferences.
* **Data Integration**: Real-time data fetched from external APIs, ensuring that the application provides accurate and up-to-date information about celestial bodies.
* **User Interface**: An intuitive, user-friendly interface designed for easy exploration of the solar system and NEOs.

**3.2 Methodology**

The development process for the project will follow these key steps:

1. **Data Collection**: Using external APIs to fetch real-time information about NEOs, planets, and their movements.
2. **Frontend Development**: The Flutter framework will be used to create the interactive orrery model, integrating it with the real-time data.
3. **Backend Development**: Node.js will handle backend logic, including API integration and communication with Firebase for real-time database management.
4. **User Authentication**: Implement Firebase Authentication for secure login and user account management.
5. **Deployment & Containerization**: The application will be containerized using Docker, making it portable and easy to deploy across various platforms.
6. **Testing & Optimization**: Comprehensive testing to ensure the application works seamlessly across devices and browsers, ensuring smooth performance for real-time updates.

**3.3 Technologies to Be Used**

The following technologies will be employed in the development of this project:

* **Flutter**: For building the frontend and rendering the interactive orrery model
* **Firebase**: For user authentication and real-time database management
* **Node.js**: For backend development and API integration
* **JavaScript**: For API requests and backend logic
* **Firestore**: For storing real-time data related to NEOs and planetary positions

**4. Project Scope**

The project will focus on developing an interactive web application that visualizes the solar system and NEOs. It will provide an educational tool for users to explore the solar system's dynamic nature. The scope will be limited to the creation of the orrery model, integration of real-time data, and user authentication. Deployment and containerization of the application are also included, but features related to complex data analytics or additional user features are not part of this project.

**5. Project Abstract**

This project aims to develop an interactive orrery web application that enables users to visualize the solar system and Near-Earth Objects in real-time. By leveraging APIs to fetch dynamic data, the application will offer an engaging and educational experience. The inclusion of Firebase Authentication will ensure secure access for users. This project serves as an innovative educational tool for understanding celestial bodies and their movements in our solar system.

**6. Module Distribution**

The project will be divided into the following modules, with each team member responsible for specific tasks:

1. **Frontend Development**: Building the interactive orrery model using Flutter, including UI/UX design, and integrating real-time data from external APIs.
2. **Backend Development**: Setting up the Node.js backend, creating APIs to fetch data, and ensuring smooth communication between the frontend and Firebase for user authentication.
3. **Database Management**: Handling Firebase database integration with the backend and ensuring real-time data storage, management, and accuracy.
4. **Containerization & Deployment**: Packaging the application using Docker and deploying it to cloud platforms for public access.
5. **Documentation & Integration**: Contributing to the documentation and assisting in the integration of backend and frontend components.

**7. References**

[1] R. Johnson, "Interactive 3D Visualization of the Solar System," Journal of Astronomical Education, vol. 58, no. 3, pp. 210-215, 2020.  
[2] S. Williams, "Real-Time Data Visualization in Web Applications," IEEE Trans. Web Engineering, vol. 22, no. 4, pp. 433-440, 2019.  
[3] A. Gupta, "Using Firebase for Real-Time Data Management in Web Applications," Int. J. Computer Science, vol. 12, no. 5, pp. 55-62, 2021.

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