RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

(AN AUTONOMOUS INSTITUTE)

A MINI PROJECT BY:

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OF

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

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BONAFIDE CERTIFICATE

Certified that this project 'COLLISION TRACKING APP' is the bonafide work of **“ARAVINTHAA S , DARSHAN M “** who carried out the project work under my supervision.

Submitted for the practical examination held on _____

SIGNATURE

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INTERNAL EXAMINER EXTERNAL EXAMINER

ABSTRACT

The Collision Tracking App is a software application developed using Java Swing and JDBC to provide a detailed analysis of space debris and its collision risks. Integrated with a MySQL database, the application enables users to load, filter, analyze, add, update, and delete space debris data.

The system allows real-time interaction with the database to assess collision risks based on debris characteristics like size, speed, and orbit. This app serves as a tool for space researchers to monitor and manage space debris effectively, ensuring data accuracy and user-friendly operations.

This project highlights the practical use of Java Swing for GUI development and JDBC for database connectivity, offering a functional solution to manage and track space debris.

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INTRODUCTION

1.1 Project Overview

The Collision Tracking App is a Java-based application developed to assist space researchers in tracking and managing space debris. Using Java Swing for GUI and JDBC for database interaction, this tool enables users to analyze and mitigate potential collision risks.

1.2 Objective

The objective of this project is to provide a streamlined solution to:

- Load and visualize space debris data from the database.
- Analyze and filter debris based on collision risk.
- Perform CRUD (Create, Read, Update, Delete) operations efficiently.

1.3 Scope of the Application

This application offers:

- A user-friendly GUI to interact with space debris data.
- Real-time collision risk analysis.
- Comprehensive database integration to store and manage debris information.

1.4 Application Features

- Load and display space debris details.
- Add, update, and delete debris records.
- Filter debris by collision risk (low/high).
- Analyze collision risk using real-time database data.

1.5 Benefits and Use Case

Benefits:

- Real-Time Analysis: The application allows users to analyze collision risks dynamically by pulling updated data from the database.
- User-Friendly Interface: Designed with a simple and intuitive GUI, making it accessible even for non-technical users.
- Custom Filtering: Provides the ability to filter data based on collision risk levels, ensuring precise risk assessment.
- Efficient Management: Enables space research teams to effectively track and manage debris, minimizing collision risks.

Use Case:

The Collision Tracking App is particularly useful for:

- Space Agencies: To monitor debris and mitigate collision risks for satellites and space stations.
- Academic Research: Serves as a tool for students and researchers studying orbital debris and its impact.
- Real-Time Simulations: Can be extended for simulations in space mission planning and collision avoidance strategies.

2. SYSTEM SPECIFICATIONS

2.1 Hardware Specifications

- Processor: Intel i5 or equivalent
- Memory: Minimum 4 GB RAM
- Storage: At least 500 GB of free disk space
- Display: 1024 x 768 resolution or higher0

2.2 Software Specifications

- Programming Language: Java (JDK 11 or higher)
- Database: MySQL 8.0
- Development Environment: IntelliJ IDEA / Eclipse
- Operating System: Windows 10 or Linux-based OS
- Libraries/Frameworks: Java Swing, JDBC

3. SAMPLE CODE

3.1 GUI Design and Layout

The graphical user interface is designed using Java Swing with a focus on intuitive interactions. Below is a snippet to demonstrate the layout setup:

```
public CollisionTrackingApp() {

    JFrame frame = new JFrame("Collision Tracking App");

    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

    frame.setSize(1000, 700);

    frame.getContentPane().setBackground(new Color(240, 248, 255));


    String[] columnNames = {"ID", "Size", "Speed", "Orbit", "Collision Risk"};

    model = new DefaultTableModel(columnNames, 0);

    table = new JTable(model);

    table.setRowHeight(30);

    table.setFont(new Font("Arial", Font.PLAIN, 14));

    table.getTableHeader().setFont(new Font("Arial", Font.BOLD, 16));

    table.getTableHeader().setBackground(new Color(173, 216, 230));


    collisionRiskColumn = table.getColumnModel().getColumn(4);


    JScrollPane scrollPane = new JScrollPane(table);

    scrollPane.setBorder(BorderFactory.createTitledBorder("Space Debris Data"));


    JPanel buttonPanel = new JPanel();
```

```
    buttonPanel.setBackground(new Color(240, 248, 255));
    setupButtonPanel(buttonPanel);

    JPanel filterPanel = new JPanel(new FlowLayout(FlowLayout.LEFT));
    filterPanel.setBackground(new Color(240, 248, 255));
    JLabel filterLabel = new JLabel("Collision Risk Filter:");
    riskFilterField = new JTextField(5);
    filterPanel.add(filterLabel);
    filterPanel.add(riskFilterField);

    frame.add(scrollPane, BorderLayout.CENTER);
    frame.add(buttonPanel, BorderLayout.SOUTH);
    frame.add(filterPanel, BorderLayout.NORTH);

    frame.setLocationRelativeTo(null);
    frame.setVisible(true);

    hideCollisionRiskColumn();
}

private void hideCollisionRiskColumn() {
    collisionRiskColumn.setMinWidth(0);
    collisionRiskColumn.setMaxWidth(0);
```

```
    collisionRiskColumn.setPreferredWidth(0);
    isCollisionRiskVisible = false;
}

private void showCollisionRiskColumn() {
    collisionRiskColumn.setMinWidth(75);
    collisionRiskColumn.setMaxWidth(200);
    collisionRiskColumn.setPreferredWidth(100);
    isCollisionRiskVisible = true;
}
```

3.2 Data Loading Operation

The loadData method loads debris details from the MySQL database and populates the table:

```
private void loadData() {
    model.setRowCount(0);
    String query = "SELECT debris_id, debris_size, debris_speed, debris_orbit, collision_risk FROM SpaceDebris";

    try (Connection conn = DriverManager.getConnection(URL, USER, PASS);
         Statement stmt = conn.createStatement();
         ResultSet rs = stmt.executeQuery(query)) {

        while (rs.next()) {
```

```
            int debrisId = rs.getInt("debris_id");
            float size = rs.getFloat("debris_size");
            float speed = rs.getFloat("debris_speed");
            String orbit = rs.getString("debris_orbit");
            float collisionRisk = rs.getFloat("collision_risk");

            model.addRow(new Object[]{debrisId, size, speed, orbit, collisionRisk});
        }

        hideCollisionRiskColumn();

    } catch (SQLException ex) {
        JOptionPane.showMessageDialog(null, "Database error: " + ex.getMessage(), "Error", JOptionPane.ERROR_MESSAGE);
    }
}
```

3.3 Collision Risk Analysis

This method analyzes the collision risk and reveals the "Collision Risk" column:

```
private void analyzeCollisionRisk() {
    if (isCollisionRiskVisible) {
        JOptionPane.showMessageDialog(null, "Collision Risk is already visible!", "Info", JOptionPane.INFORMATION_MESSAGE);
        return;
```

```
    }

    showCollisionRiskColumn();
}
```

3.4 Add, Update, and Delete Operations

Add Data:

```
private void addData() {
    String debrisIdStr = JOptionPane.showInputDialog("Enter Debris ID:");
    String sizeStr = JOptionPane.showInputDialog("Enter Debris Size:");
    String speedStr = JOptionPane.showInputDialog("Enter Debris Speed:");
    String orbitStr = JOptionPane.showInputDialog("Enter Debris Orbit:");

    try {
        int debrisId = Integer.parseInt(debrisIdStr);
        float size = Float.parseFloat(sizeStr);
        float speed = Float.parseFloat(speedStr);
        String orbit = orbitStr;

        float collisionRisk = 0; // Default value

        model.addRow(new Object[]{debrisId, size, speed, orbit, collisionRisk});
    } catch (NumberFormatException ex) {
```

```
        JOptionPane.showMessageDialog(null, "Invalid data format.", "Error", JOptionPane.ERROR_MESSAGE);
    }
}
```

Delete Data:

```
private void deleteData() {
    int selectedRow = table.getSelectedRow();
    if (selectedRow != -1) {
        model.removeRow(selectedRow);
    } else {
        JOptionPane.showMessageDialog(null, "Please select a row to delete.", "Error", JOptionPane.ERROR_MESSAGE);
    }
}
```

Update Data:

```
private void updateData() {
    int selectedRow = table.getSelectedRow();
    if (selectedRow != -1) {
        String debrisIdStr = JOptionPane.showInputDialog("Enter new Debris ID:");
        String sizeStr = JOptionPane.showInputDialog("Enter new Debris Size:");
        String speedStr = JOptionPane.showInputDialog("Enter new Debris Speed:");
        String orbitStr = JOptionPane.showInputDialog("Enter new Debris Orbit:");
```

```
        try {
            int debrisId = Integer.parseInt(debrisIdStr);
            float size = Float.parseFloat(sizeStr);
            float speed = Float.parseFloat(speedStr);
            String orbit = orbitStr;

            model.setValueAt(debrisId, selectedRow, 0);
            model.setValueAt(size, selectedRow, 1);
            model.setValueAt(speed, selectedRow, 2);
            model.setValueAt(orbit, selectedRow, 3);
            model.setValueAt(0, selectedRow, 4); // Default collision risk

        } catch (NumberFormatException ex) {
            JOptionPane.showMessageDialog(null, "Invalid data format.", "Error", JOptionPane.ERROR_MESSAGE);
        }
    } else {
        JOptionPane.showMessageDialog(null, "Please select a row to update.", "Error", JOptionPane.ERROR_MESSAGE);
    }
}
```

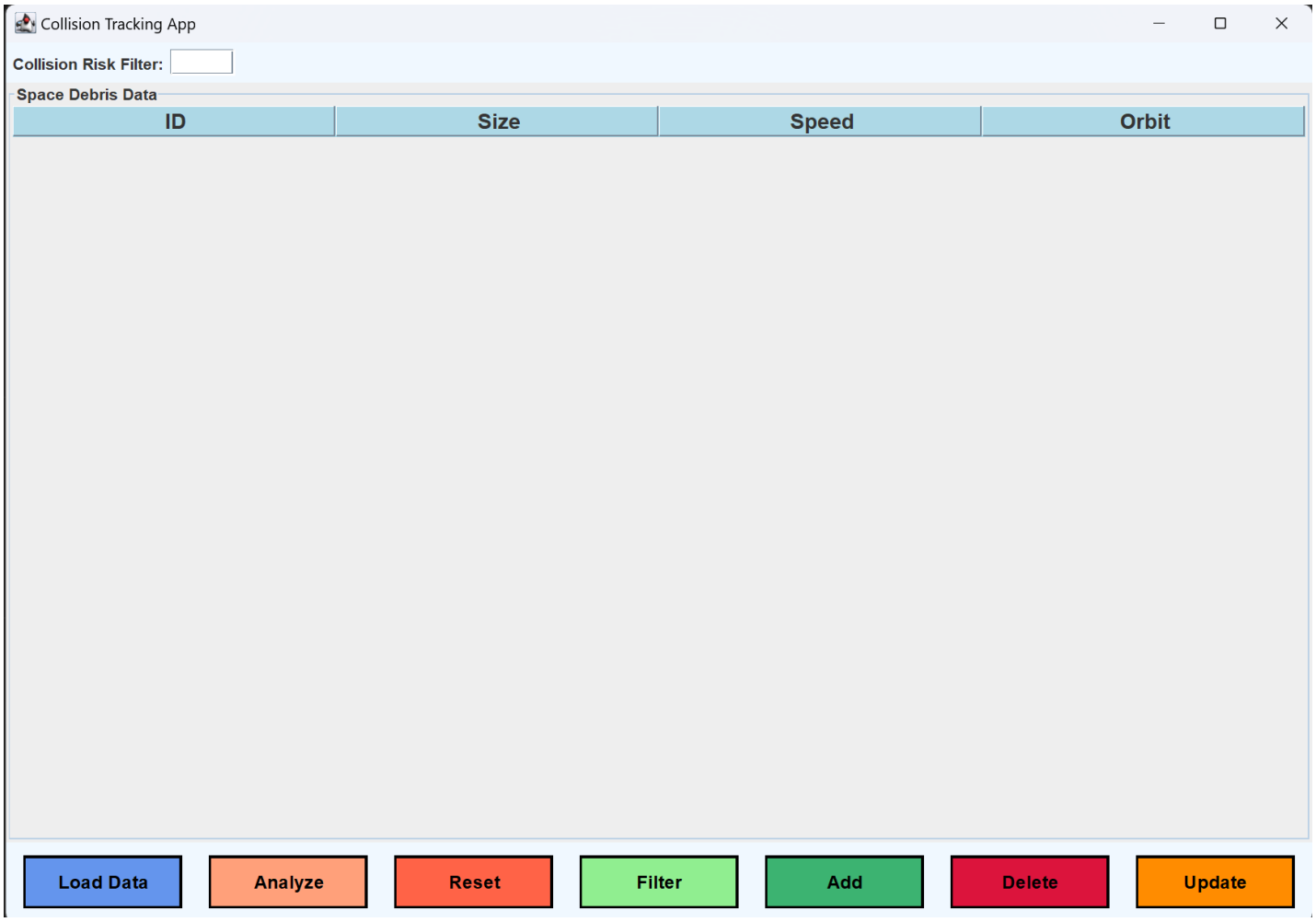
3.5 Filtering Space Debris Data

The method filters debris data based on the entered collision risk threshold:

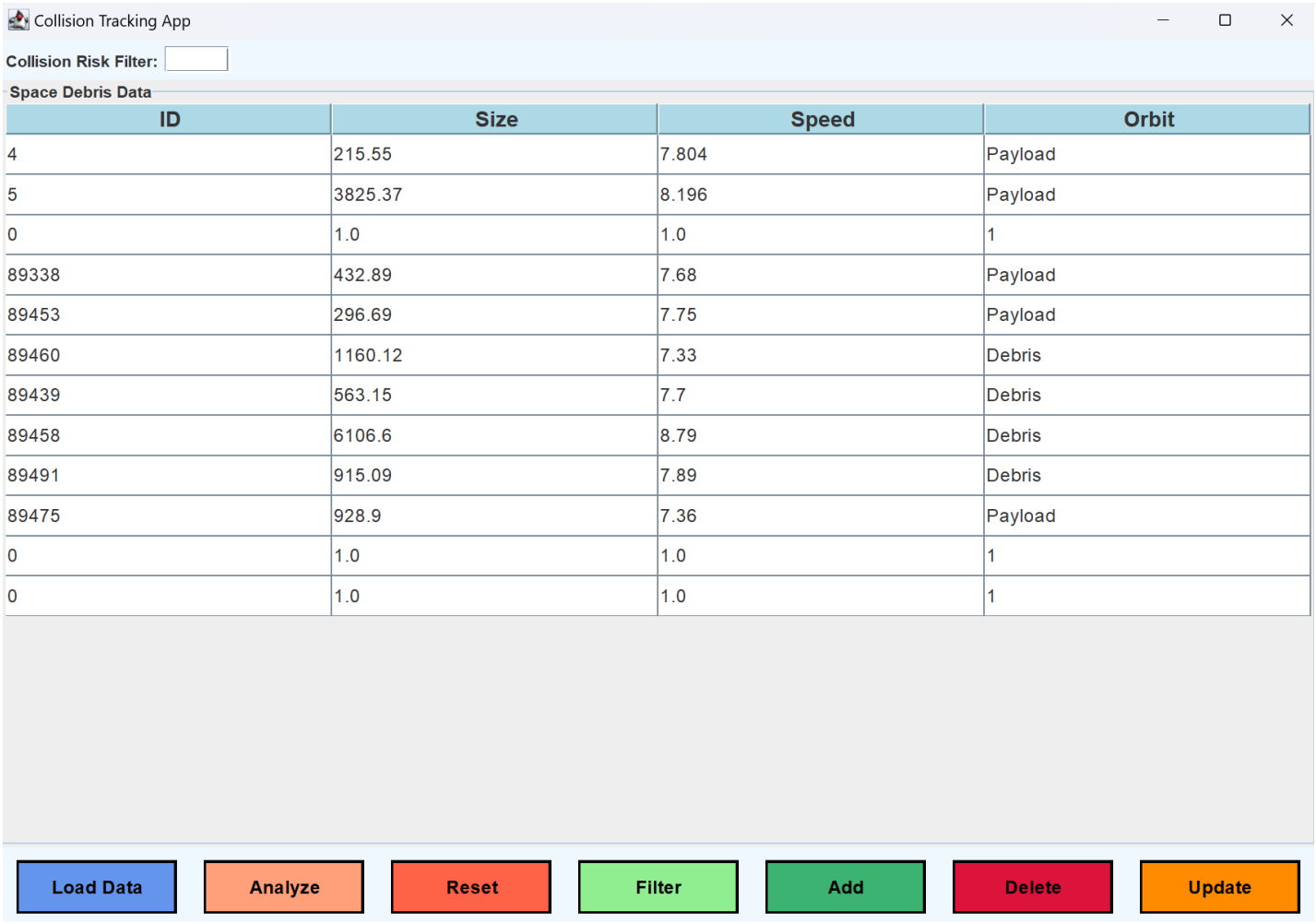
```
private void filterByCollisionRisk() {
    String riskThresholdStr = riskFilterField.getText();
    if (!riskThresholdStr.isEmpty()) {
        try {
            float riskThreshold = Float.parseFloat(riskThresholdStr);
            for (int i = 0; i < model.getRowCount(); i++) {
                float collisionRisk = (float) model.getValueAt(i, 4);
                if (collisionRisk < riskThreshold) {
                    model.removeRow(i);
                    i--; // Adjust index after removal
                }
            }
        } catch (NumberFormatException ex) {
            JOptionPane.showMessageDialog(null, "Invalid collision risk filter value.", "Error", JOptionPane.ERROR_MESSAGE);
        }
    }
}
```

4. SNAPSHOTS

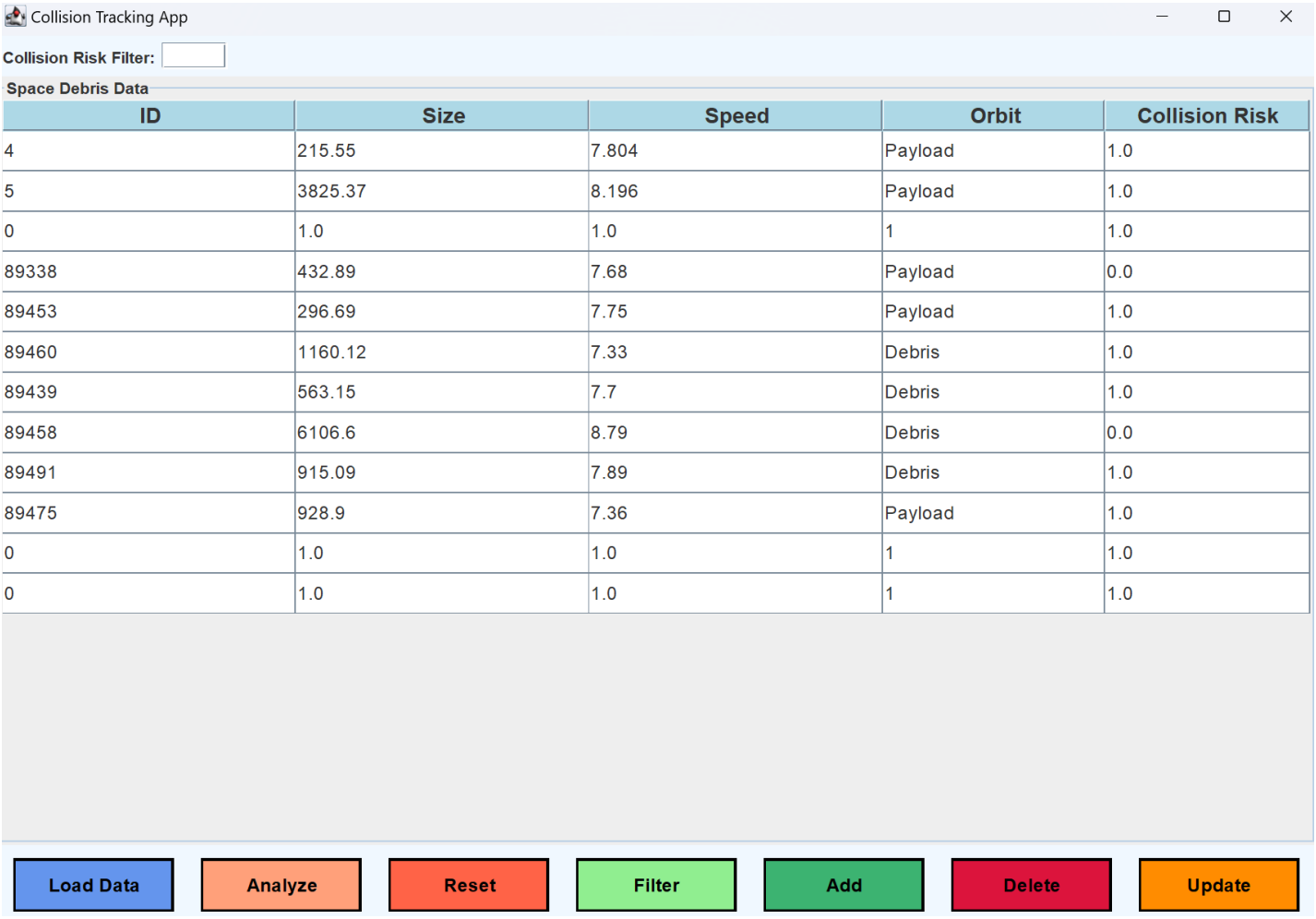
4.1. Home Page



4.2 Data Loading

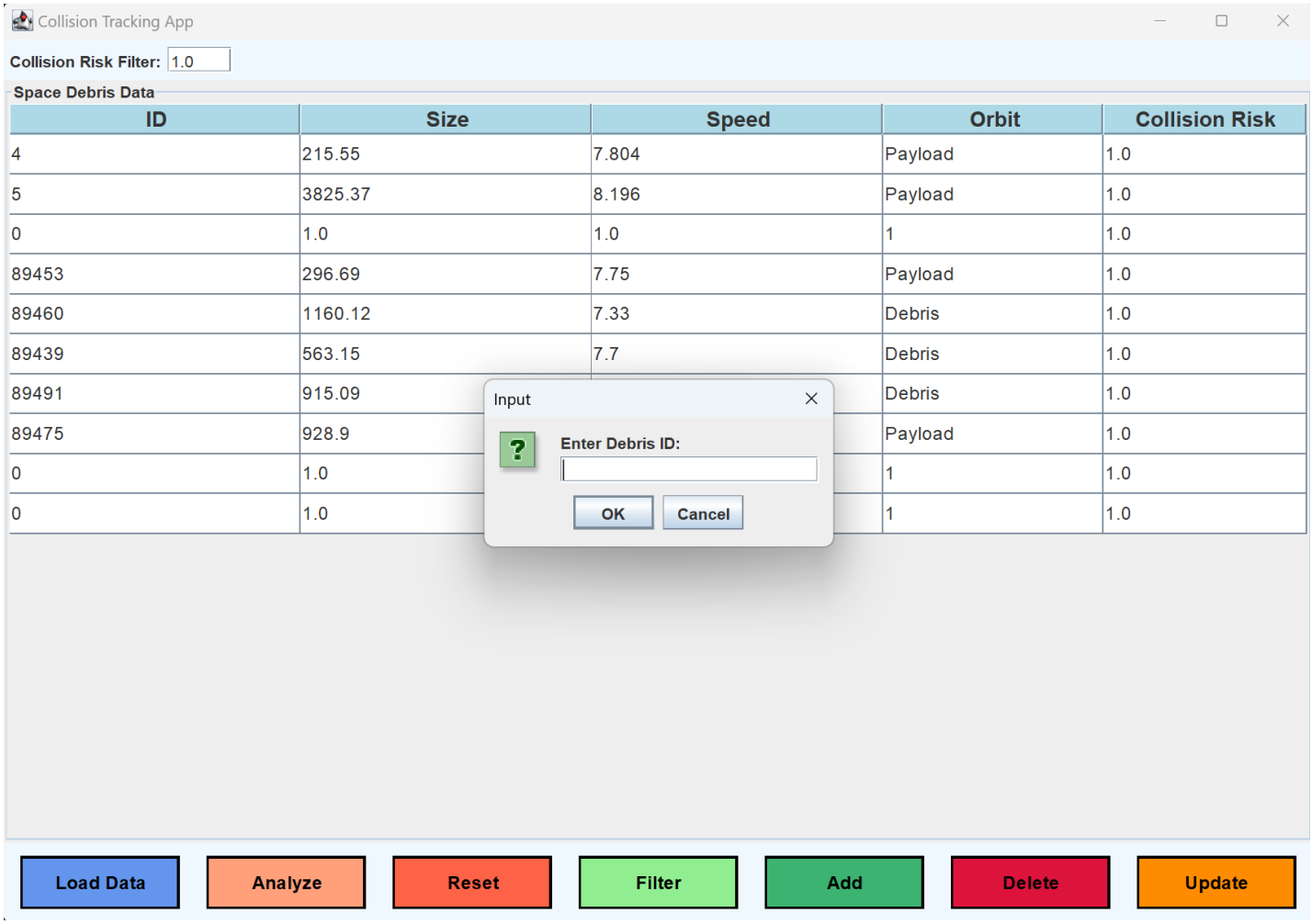


4.3 Collision Risk Analysis

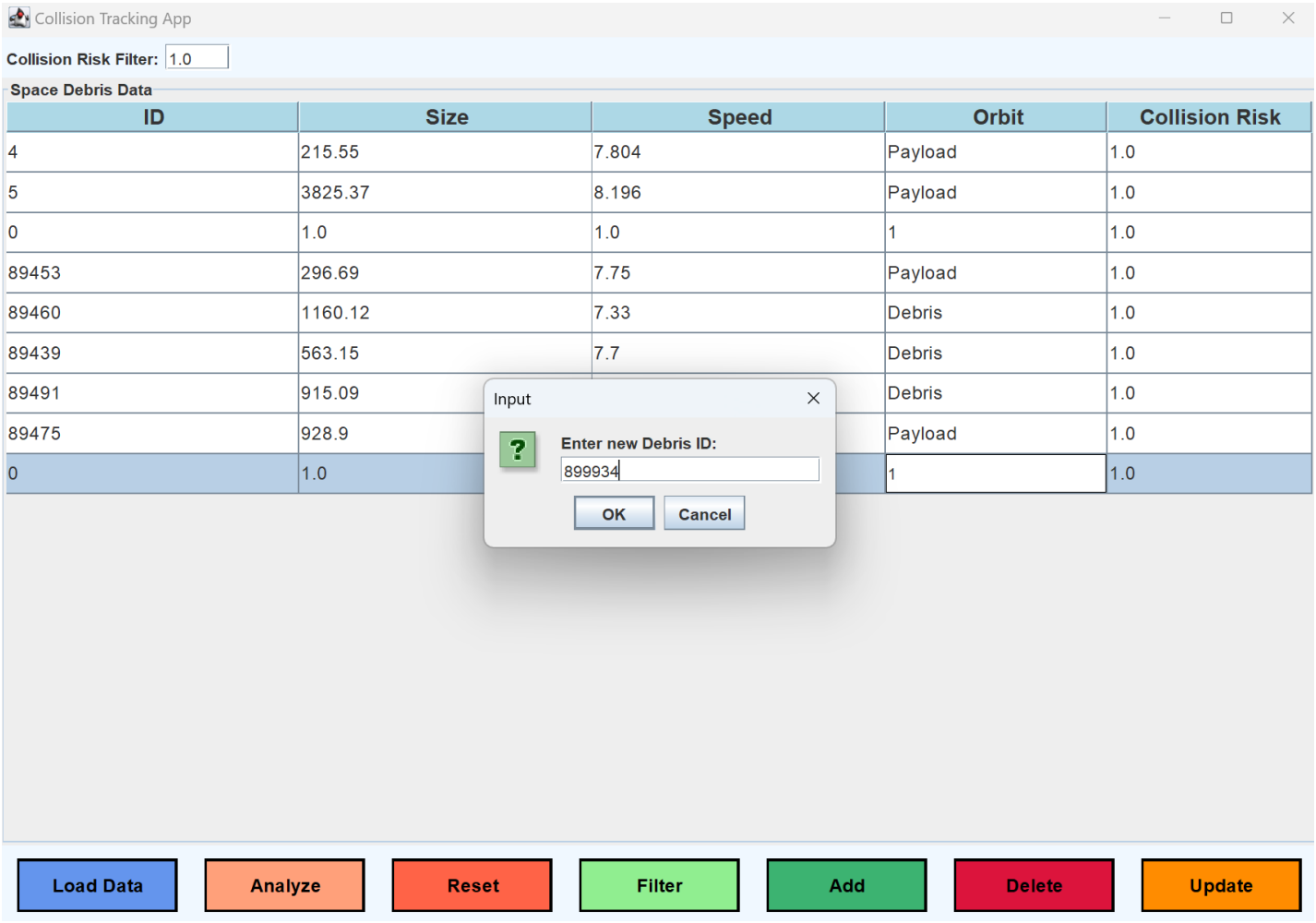


4.4 Add, Update, and Delete Features

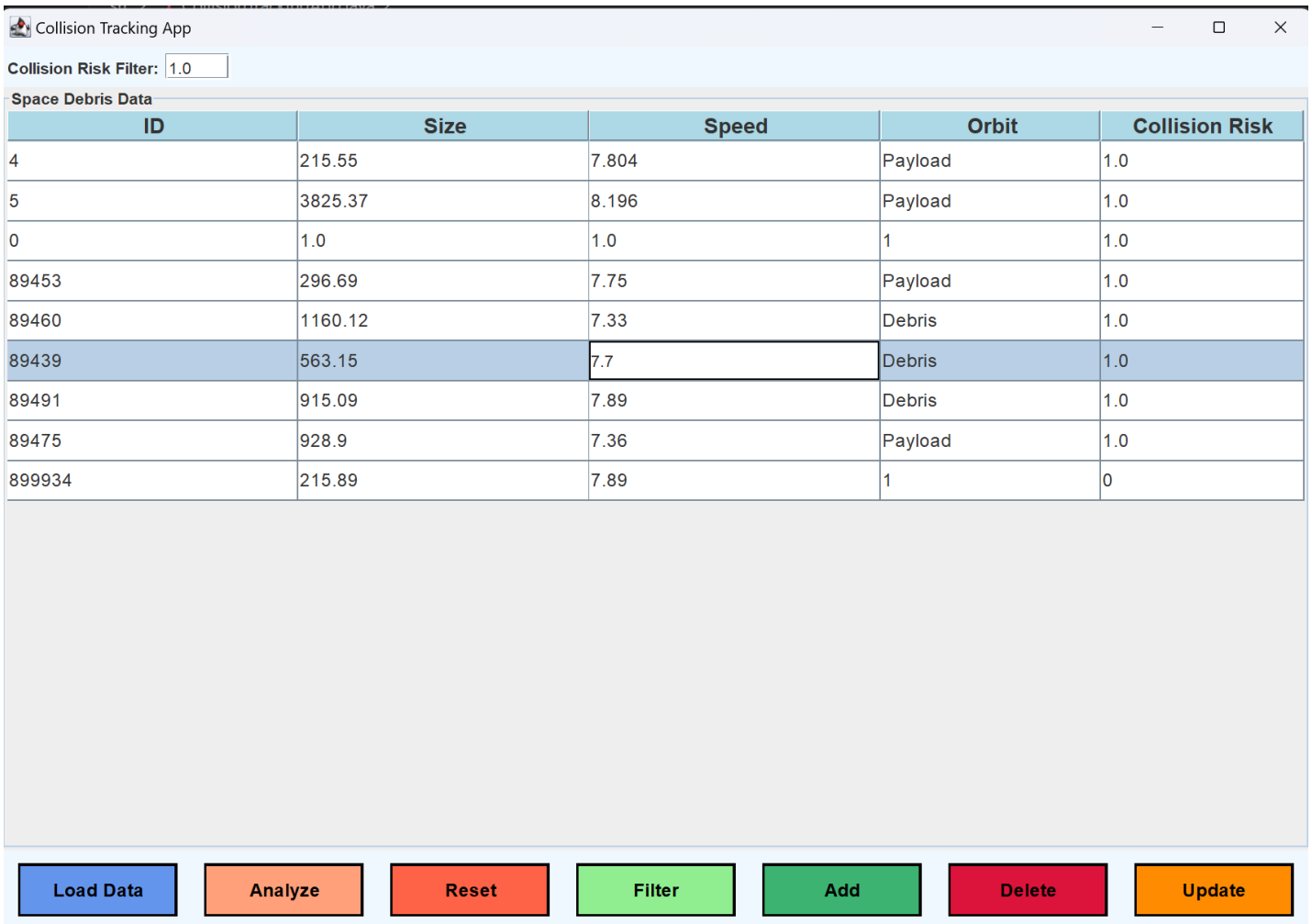
Add



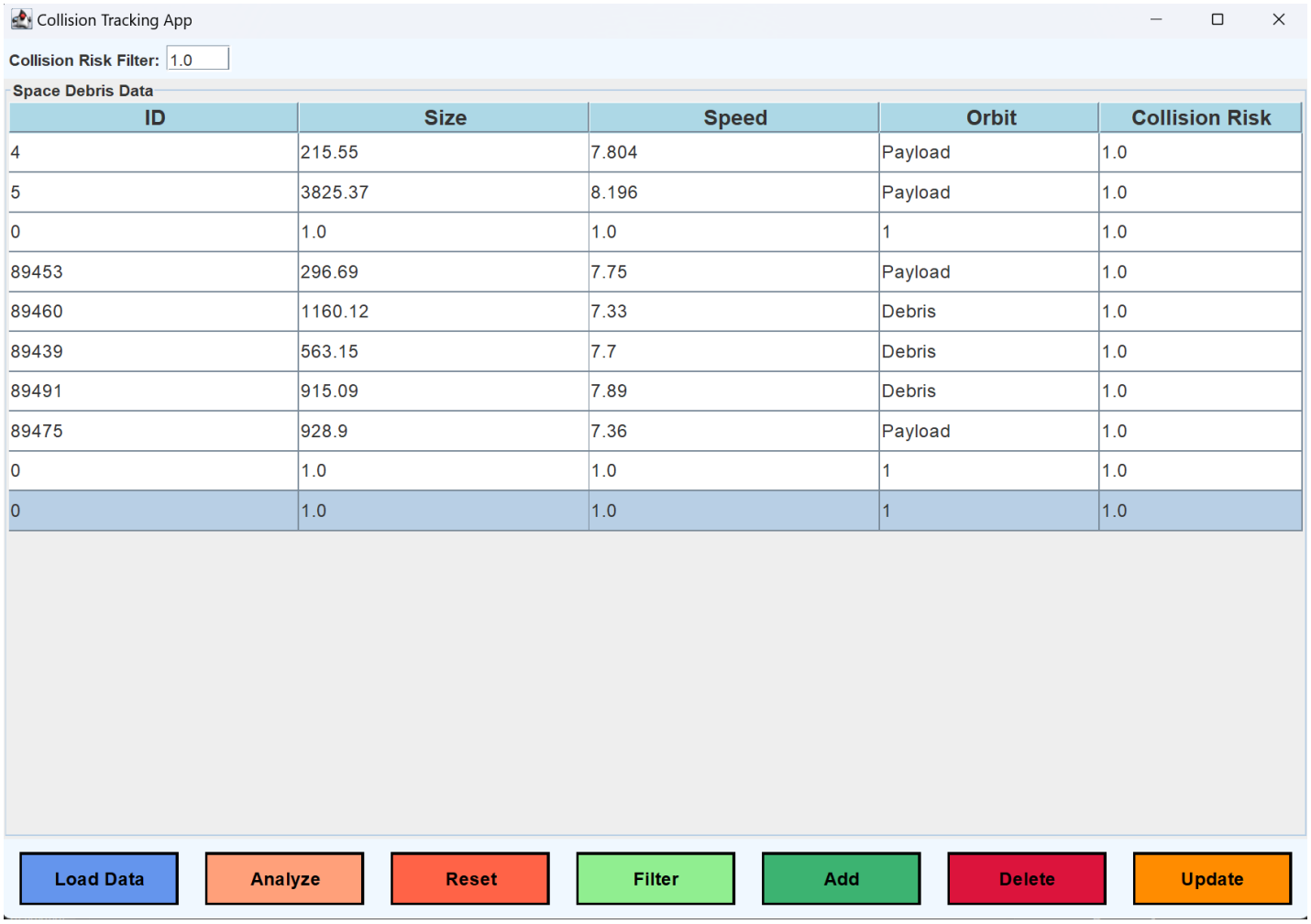
Before Update :



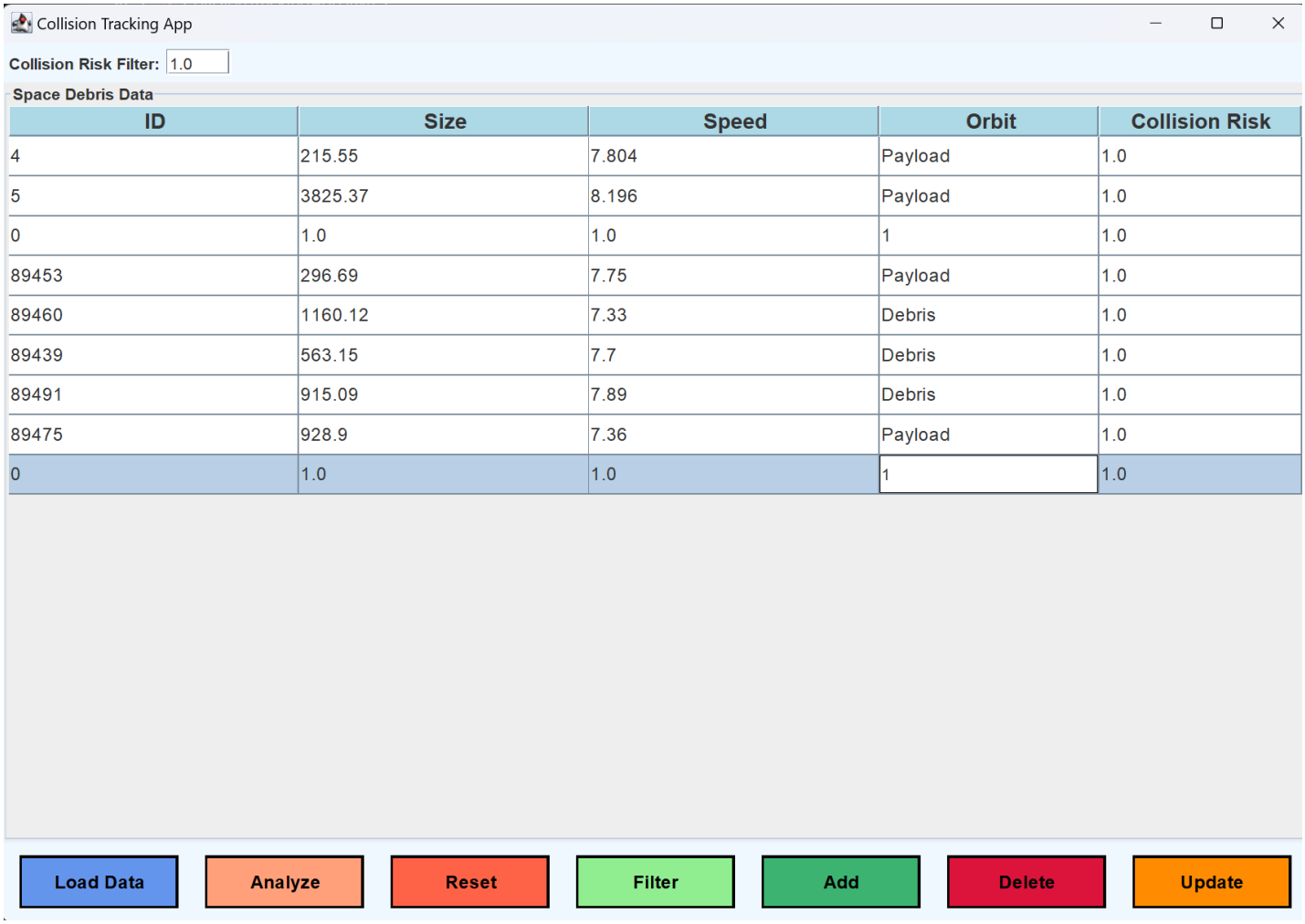
After Update:



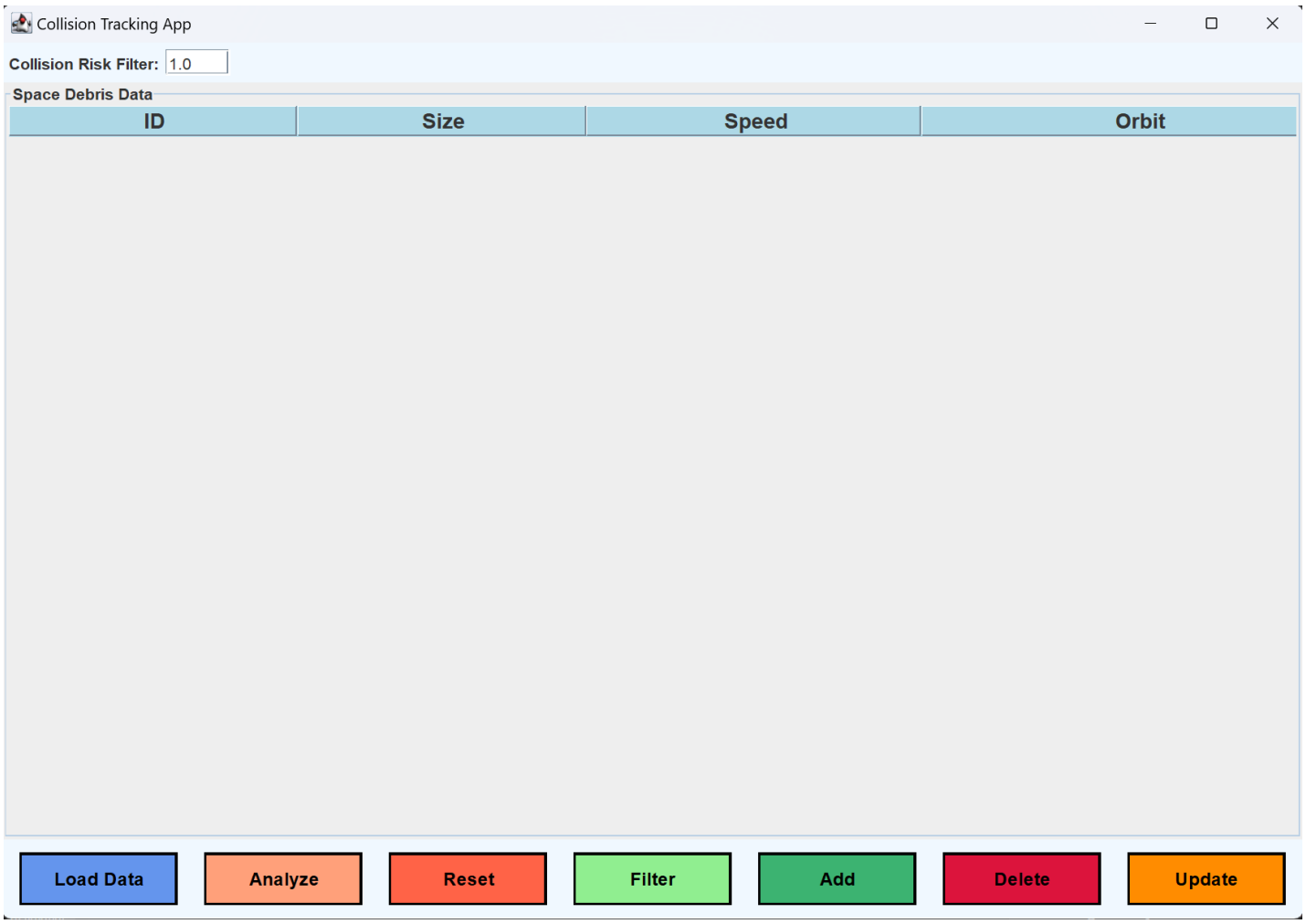
Before Delete:



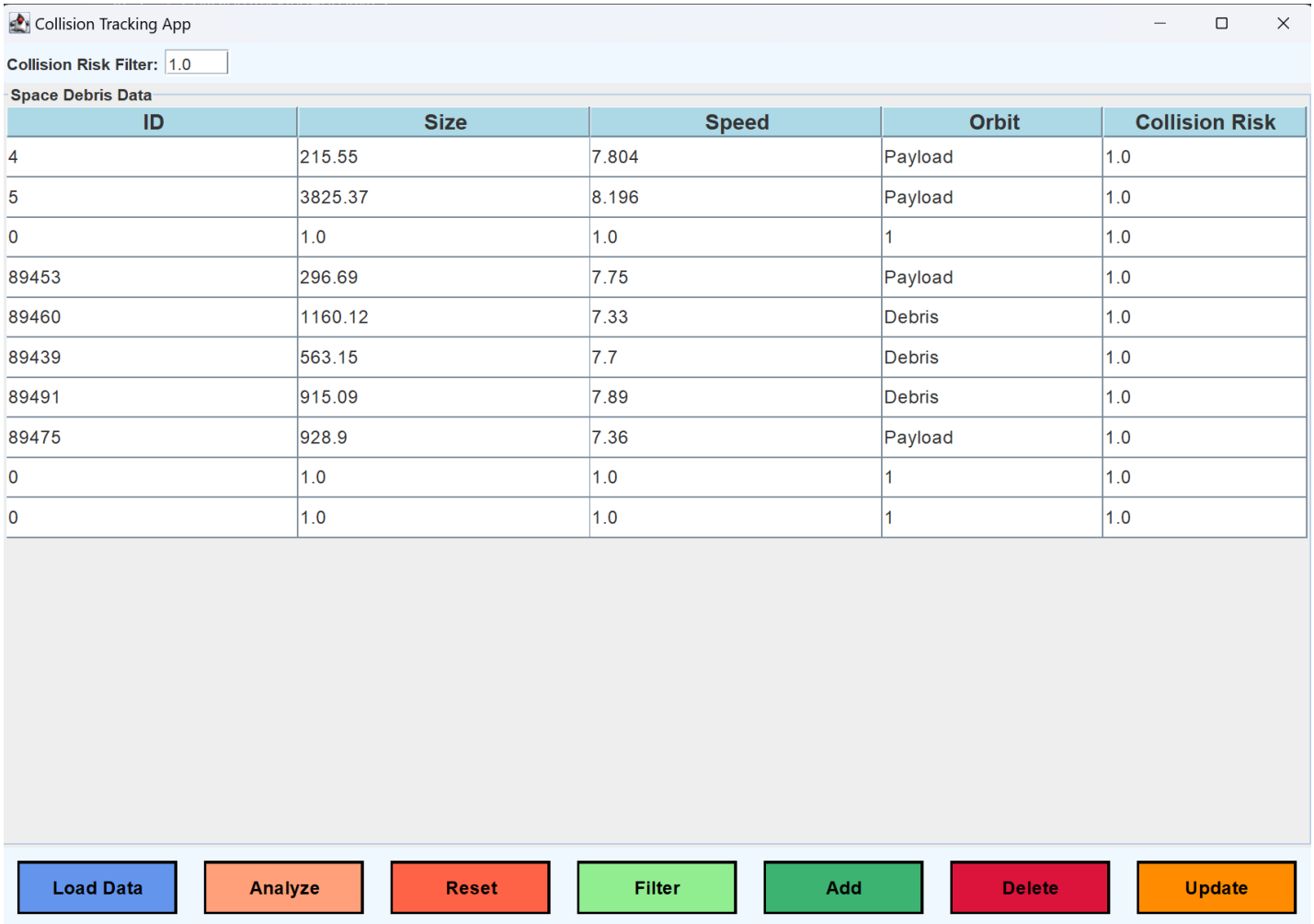
After Delete:



Reset :


Collision Tracking App
Collision Risk Filter: 1.0
Space Debris Data
ID
Size
Speed
Orbit
Load Data
Analyze
Reset
Filter
Add
Delete
Update

4.5 Filter by Collision Risk



CONCLUSION

The **Collision Tracking App** provides an efficient and user-friendly solution for managing and analyzing space debris data. By leveraging Java Swing for an intuitive graphical user interface and JDBC for seamless database integration, the application offers essential features like real-time collision risk analysis, data filtering, and CRUD (Create, Read, Update, Delete) operations.

The project demonstrates practical applications of software development concepts, including GUI design, database management, and real-time data analysis. This app is particularly beneficial for space research agencies and academic institutions, offering a robust tool to monitor, track, and mitigate the risks posed by space debris.

The development of this application highlights the integration of technology and problem-solving skills, paving the way for future enhancements such as predictive modeling and integration with live satellite tracking systems.

6. REFERENCES

1. https://www.javatpoint.com/java-tutorial

2. https://dev.mysql.com/doc/

3. https://docs.oracle.com/javase/tutorial/