Title: Space Mission Analysis Report

Declaration

I hereby declare that the Minor Project Report titled *"Space Mission Analysis Report"* submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering is a record of my original work. This report has not been submitted elsewhere for the award of any degree.

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Certificate

This is to certify that the Minor Project Report titled *"Space Mission Analysis Report"* submitted by **ANSH OJHA**, Registration Number **[12312163]**, of the School of Computer Science and Engineering, Lovely Professional University, has been carried out under my supervision. This report is a bona fide record of the work carried out during the academic session as a part of the Minor Project course.

Project Guide:
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Head of Department
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Acknowledgment

I express my sincere gratitude to my project guide **[Dr. Karan bajaj]** for his/her valuable guidance, continuous encouragement, and constant supervision throughout the project. I am also thankful to the Head of Department , and all the faculty members of the School of Computer Science and Engineering, LPU, for their support. Finally, I thank my peers and family for their motivation and help throughout the project duration.

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1. Introduction

The advancement of space technology has witnessed a rapid evolution over the past few decades. Numerous public and private organizations have been involved in launching satellites, conducting research missions, and exploring outer space. This report presents a comprehensive analysis of a dataset consisting of over 1200 space missions, aiming to extract meaningful insights about mission outcomes, companies involved, rocket types, launch locations, and associated costs. The analysis will help in understanding trends, success rates, and the evolving landscape of space missions worldwide.

2. Dataset Description

The dataset, titled "Space Mission.xlsx", includes 1267 entries and contains information on a wide array of missions from various space agencies and companies. The primary columns of the dataset are:

- **Company**: Name of the organization responsible for the mission (e.g., NASA, SpaceX, Roscosmos).

- **Location**: Launch site details.

- **Date**: The date of the mission launch.

- **Time**: Launch time (may be missing in some entries).

- **Rocket**: Name of the rocket used.

- **Mission**: Name or description of the mission.

- **Rocket Status**: Indicates whether the rocket is active, retired, etc.

- **Price**: The financial cost of the mission, where available.

- **Mission Status**: The outcome of the mission (e.g., Success, Failure, Partial Failure).

The dataset required preprocessing due to improper headers and missing data entries. The first two rows were metadata, which were removed, and relevant columns were renamed appropriately.

3. Data Cleaning and Preprocessing

- Removed metadata rows and set correct headers.

- Converted "Date" and "Time" columns into a single datetime column for analysis.

- Handled missing values in the "Time" and "Price" columns.

- Converted "Price" column into numeric data type for financial analysis.

- Standardized "Mission Status" values for consistency.

4. Exploratory Data Analysis (EDA)

The cleaned dataset was explored to understand the underlying trends and patterns:

4.1. Mission Distribution by Company

- SpaceX, NASA, and Roscosmos emerged as the leading organizations in terms of mission count.

- A significant number of launches have been conducted by the US Air Force and other defense organizations.

4.2. Launch Sites

- Major launch locations include Cape Canaveral (USA), Baikonur Cosmodrome (Kazakhstan), and Vandenberg AFB (USA).

4.3. Mission Outcomes

- A majority of missions were successful, but failures and partial failures were observed in several early or experimental missions.

- The overall success rate was above 90% for most leading companies.

4.4. Rocket Usage

- Frequently used rockets include Falcon 9, Soyuz, Atlas V, and Ariane 5.

- Rocket status indicates a large number of missions are conducted using retired or legacy rocket systems.

4.5. Cost Analysis

- Mission costs ranged widely, from a few million to over a billion dollars.

- NASA missions, especially involving Space Shuttles, had some of the highest costs.

- Several commercial missions by SpaceX and others were conducted at lower costs.

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5. Key Insights

- SpaceX has disrupted the traditional space industry by increasing launch frequency and reducing costs.

- Government agencies still dominate the total number of missions, but private players are catching up fast.

- Launch success rates have significantly improved over the years.

- Launch costs vary significantly based on mission complexity, rocket type, and organization.

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6. Conclusion

This report provides a bird's eye view of the global space mission landscape. It highlights the increasing involvement of private entities, the reliability of specific rocket models, and the overall improvement in mission outcomes. Organizations can leverage this information to optimize planning, budgeting, and execution of future missions.

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7. Future Scope

- Incorporate payload information to analyze scientific vs. commercial missions.

- Use time-series analysis to forecast future missions and launch costs.

- Explore correlations between rocket models and mission outcomes.

- Integrate satellite tracking data to analyze post-launch mission success.

Appendices

- **Appendix A**: Sample data entries.

- **Appendix B**: Code snippets used for data cleaning and analysis (available on request).

- **Appendix C**: Visualizations and charts (optional graphical supplement).

End of Report