1 Altitude Data Processing with `altitude_data.py`

This document provides an overview of how the `altitude_data.py` script processes altitude data for the Balloon project.

1.1 Overview

The `altitude_data.py` script is designed to read, process, and analyze altitude data stored in a text file (`altitude_data.txt`). It is a critical component of the Balloon project, enabling the evaluation of flight performance and environmental conditions.

1.2 Data Input

The script reads altitude data from a file named `altitude_data.txt`. The data is expected to be in a structured format, with each line representing a single altitude measurement in meters. For example:

```
100
150
200
250
```

1.3 Data Processing

The script processes the altitude data using the following steps:

1. **File Reading:** The script opens `altitude_data.txt` in read mode and loads the data into memory.
2. **Data Cleaning:** Any invalid or non-numeric entries are filtered out to ensure the integrity of the dataset.
3. **Statistical Analysis:** The script calculates key metrics such as:
    - **Mean Altitude:** The average altitude across all measurements.
    - **Maximum Altitude:** The highest altitude recorded.
    - **Minimum Altitude:** The lowest altitude recorded.
4. **Visualization:** The script generates plots to visualize altitude trends over time, if applicable.

1.4 Key Functions

The following are the primary functions implemented in `altitude_data.py`:

- `read_data(file_path)`: Reads altitude data from the specified file path.
- `clean_data(data)`: Cleans and validates the input data.

- `calculate_statistics(data)`: Computes statistical metrics such as mean, max, and min altitude.
- `plot_data(data)`: Generates visualizations of the altitude data.

1.5 Example Usage

To use the script, ensure that `altitude_data.txt` is located in the same directory as `altitude_data.py`. Then, run the script as follows:

```
python altitude_data.py
```

The output will include statistical summaries and any generated plots.

1.6 Future Enhancements

Planned improvements for `altitude_data.py` include:

- Support for real-time altitude data streaming.
- Integration with external APIs for weather and environmental data.
- Enhanced visualization options, such as 3D plots.

2 Changelog

This section provides a summary of changes made to the Balloon project.

2.1 Version 1.0.0 (4/14/2025)

2.1.1 Features

- Added `main.cpp` in the `src/` folder for core functionality.
- Added `testing.cpp` in the `src/` folder for altitude data processing.
- Added `altitude_data.py` and `altitude_data.txt` in the `Altitude Testing/` folder for altitude testing and data storage.
- Added `Adafruit_Examples.cpp`, `Cpp_Example.cpp`, and `Prof_Cpp_Example.cpp` in the `Examples/` folder for example implementations.
- Added `README` files in the `include/` and `lib/` folders for documentation.
- Added `Meeting Notes/` and `Project Notes/` in the `Notes/` folder for project-related notes.
- Added `changelog.txt`, `todo.txt`, and `LaTeX/` folder in the `Documentation/` folder for project documentation.
- Added `.vscode/` folder with configuration files for Visual Studio Code.
- Added `platformio.ini` for PlatformIO project configuration.

2.1.2 Changes

- Reorganized files into a structured folder hierarchy for better project management.
- Modified `testing.cpp` to include functionality for reading and processing altitude data from `altitude_data.txt`.

2.1.3 Bug Fixes

- None.