## Autonomous Navigation System for Spacecraft and Rovers:

**Key Components:**

**1. Calculations:**

- **Perception (Terrain and Obstacle Detection):**
  - Convolution operations for feature extraction in CNNs.
  - SoftMax function for classification probabilities.
- **Path Planning:**
  - Dijkstra's Algorithm and A* Algorithm for static pathfinding.
  - Bellman Equation in Q-Learning for dynamic decision-making.
- **Control (Physics-Based Simulations):**
  - Position update using trigonometric functions and time steps.
  - Velocity and acceleration calculations for motion simulation.

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**2. Libraries and Frameworks:**

- **Machine Learning and Computer Vision:**
  - TensorFlow/Keras, PyTorch (for model training).
  - OpenCV (for image processing and obstacle detection).
- **Simulation Environments:**
  - OpenAI Gym (lightweight grid-based simulations).
  - or
  - Unity ML-Agents (advanced 3D physics-based simulations).
- **Pathfinding:**
  - NumPy and SciPy (for matrix and heuristic computations).
  - NetworkX (for graph-based pathfinding algorithms).
- **APIs for Real-World Data:**
  - NASA APIs (planetary data).
  - OpenStreetMap (real-world navigation scenarios).

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**3. IDEs and Tools:**

- **Python IDEs:** Visual Studio Code, PyCharm, or Jupyter Notebook for development.
- **Unity Editor:** For creating and managing Unity ML-Agent's environments.
- **Colab/Anaconda:** For machine learning model training and testing.

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**4. Datasets:**

- Kaggle datasets:
  - Mars Terrain Images.
  - Asteroid Surface Images.
  - Drone Navigation Data.

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**5. Output:**

- A simulation environment where an autonomous rover/spacecraft navigates through complex terrain, avoiding obstacles and dynamically planning its path.