# CSE 3063 LAB

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## Problem Statement

Designing a Mars rover is a complex task that requires careful consideration of its major components, their dependencies, and the need for UML (Unified Modeling Language) diagrams to ensure a well-structured and efficient system. Here's an overview:

## Major Components:

1. **Chassis:** The rover's physical structure, including wheels or tracks for mobility. It supports other components and provides stability.

2. **Power Source:** Typically, this includes solar panels for generating electricity and batteries for energy storage.

3. **Computing Unit:** The rover's "brain" that controls all operations. It includes processors, memory, and onboard software for autonomous navigation and scientific data analysis.

4. **Communication System**: Enables data transmission between the rover and mission control on Earth and any orbiting satellites around Mars.

5. **Sensors:** Various sensors are used for navigation, hazard avoidance, and scientific data collection. These may include cameras, spectrometers, accelerometers, and more.

6. **Manipulator Arm:** If the rover is designed for sample collection or manipulation, it may have a robotic arm with various tools.

7. **Mobility System:** This includes wheels, suspension, and motors for movement across the Martian terrain.

8. **Instrumentation:** Scientific instruments for analyzing soil, rocks, and the Martian atmosphere.

9. **Navigation System:** GPS, gyros, and accelerometers for determining the rover's position and orientation.

10. **Environmental Control:** Systems for managing temperature, protecting against dust, and ensuring the rover's survival in extreme Martian conditions.

## Dependencies:

1. **Power Supply:** All components depend on a stable power supply. Without sufficient energy, the rover cannot function.

2. **Computing Unit:** The computing unit controls the operation of all other components, making it a central dependency.

3. **Communication System:** It's essential for sending back data to mission control and receiving commands. Without it, the rover can't be remotely operated.

4. **Sensors:** The rover relies on sensors for navigation, hazard avoidance, and scientific data collection. Faulty sensors can lead to inaccurate data or even accidents.

5. **Instrumentation:** The scientific instruments depend on power and a functional computing unit to perform their tasks and relay data.

## UML Diagrams for the Mars Rover:

UML diagrams are essential for designing, documenting, and understanding complex systems like a Mars rover. Here's why they are necessary:

1. **Structure Visualization**: UML diagrams, such as Class Diagrams, can represent the rover's components and their relationships. This helps designers and engineers grasp the system's architecture at a glance.

2. **Behavior Modeling**: UML State Diagrams can illustrate the rover's behaviour in different situations, such as during scientific data collection, navigation, or communication with Earth.

3. **Dependency Management:** UML Dependency Diagrams can help identify and manage dependencies between components. This is crucial for ensuring that each component receives the necessary inputs and can function correctly.

4. **Communication Design:** UML Sequence Diagrams can depict the flow of data and commands between the rover and mission control, aiding in the design of the communication system.

5. **Testing and Validation:** UML can be used to create Test Case Diagrams, ensuring that the rover's components and systems are thoroughly tested for reliability and functionality.

6. **Documentation:** UML diagrams serve as valuable documentation for engineers, scientists, and mission planners, helping them understand the rover's design and operation.