Arm Mechanism

Introduction:-

The rover is equipped with a rudimentary 3D robotic arm configuration, featuring three servo motors. One servo motor is dedicated to the task of sample acquisition, controlling a specific joint in the arm mechanism, denoted as Joint-1. The other two servo motors are responsible for affecting rotational movement, governing the articulation around a vertical axis, referred to as Joint-2 and Joint-3. Notably, the end-effector lacks a horizontal translation joint, indicating a limitation in its capacity for direct lateral movement.

Pickup Mechanism:-

Following object identification and verification of alignment between the center of the target object and the central axis of the robotic arm, the primary functionalities of the arm encompass two distinct operations: rotational articulation and sample acquisition.

1. **Rotational Articulation**
   The articulated movement is achieved through the controlled rotation of the servo motors associated with Joint-2 and Joint-3. The servo-03 precisely governs the vertical rotation of the robotic arm and servo-02 calibrates position of the end-effector, causing the end-effector to traverse in a controlled manner, facilitating accurate positioning for the purpose of sample capture.

2. **Sample Acquisition**
   After the arm servo-01 aligns joint-1 horizontally with precision, the gripper undergoes controlled lateral motion towards an abstract vertical axis, coinciding with the center of the targeted object, enabling successful sample capture. Subsequent to sample acquisition, servo-02 orchestrates a precise vertical rotation of the robotic arm, effectuating a controlled traversal of the end-effector. This meticulous movement ensures an accurate and stable repositioning of the arm for subsequent tasks.

Place Mechanism:-

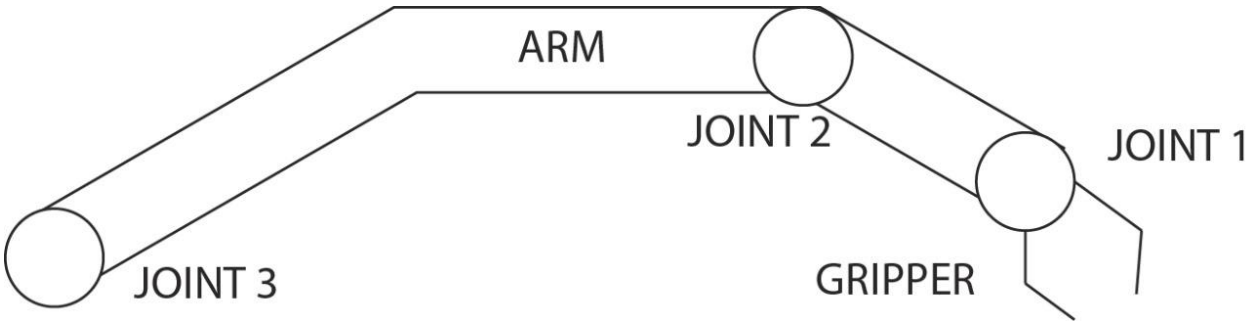
After accurately identifying the designated target location, the rover aligns itself accordingly. The primary functionalities of the robotic arm encompass two distinct operations: rotational articulation and precise placement of the sample at the predetermined location.

1. **Rotational Articulation**
   The articulated movement is achieved through the controlled rotation of the servo motors associated with Joint-2 and Joint-3. The servo-03 precisely governs the vertical rotation of the robotic arm and servo-02 calibrates position of the end-effector, causing the end-effector to traverse in a controlled manner, facilitating accurate positioning of gripper.

2. **Sample Place**
   After the arm servo-01 aligns joint-1 horizontally with precision, the gripper undergoes controlled lateral motion for the purpose of releasing the sample, aligning with the center of the designated target location. This ensures a successful and accurate release of the sample at the intended

position. Following the sample placement, servo-02 orchestrates a meticulously controlled vertical rotation of the robotic arm, facilitating a precise traversal of the end-effector. This deliberate movement guarantees an accurate and stable repositioning of the arm, ready for subsequent tasks.

Schematic:-



Justification:-

1. Three Servo Motor Configuration:

The inclusion of three servo motors (servo-01, servo-02 and servo-03) allows for dedicated control over specific joints, enhancing the arm's versatility and precision.

2. Sample Acquisition Precision:

The servo-01, controlling joint-1, enables precise horizontal alignment, ensuring accurate positioning of the gripper for controlled lateral motion. This is crucial for capturing samples with precision.

3. Rotational Articulation for Accurate Positioning:

The controlled rotation of servo-02 and servo-03, associated with Joint-2 and Joint-3, facilitates rotational articulation, allowing the end-effector to traverse in a controlled manner. This articulation ensures accurate positioning of the arm for both sample capture and placement.

4. Adaptability and Stability:

The dual-functionality of rotational articulation through servo-02 and servo-03 enhances adaptability, making the arm suitable for various tasks. The meticulous vertical rotation of the arm after each task ensures stable repositioning, readying the arm for subsequent operations.

5. Object Alignment and Target Precision:

The mechanism incorporates a systematic approach for object identification and alignment verification before executing tasks. This ensures that the arm aligns accurately with the center of the target object or location, contributing to task precision.
