**Proof of Concept**

**Objective**

The purpose of this proof of concept is to demonstrate that we can control a robotic system using the MPU6050 gyroscope/accelerometer to drive servo motor movement, with basic user feedback through an LED and LCD. This will validate the feasibility of our control and communication approach before expanding to multiple servos, grippers and wireless functionality.

**Core Idea to Prove**

* Motion sensing: Show that orientation data from MPU6050 can be read by the Arduino and translated into servo motor movement.
* User feedback: Show that LED indicators and LCD display respond appropriately to system state (power on, servo activity, basic instructions).
* System integration: Demonstrate that the Arduino can manage sensor input, actuator output and display simultaneously without system failure.

**Prototype Setup**

For the proof of concept, we will use a simplified breadboard prototype with:

* Arduino Uno (x1) – main controller
* MPU6050 Gyroscope (x1) – input sensor for orientation/movement
* Servo Motor (x1) – actuator for movement demonstration
* LED Indicator (x1) – power/servo activity feedback
* LCD Display (x1) - show simple status messages (e.g. “Power On”, “Servo Active”)
* Resistors + Jumper Wires – supporting connections

(Other listed components like gripper, multiple servos, RF communication, and buck converter will be integrated later during full prototype development)

**Test Plan**

We will validate our proof of concept through three main demonstrations

Test 1: Sensor-to-Servo Control

* Tilt the MPU6050 in one axis
* Servo rotates proportionally to the tilt
* Confirms MPU6050 can be used for motion-based control

Test 2: User Feedback

* LED turns ON when system is powered
* LED blinks while the servo is moving
* Confirms user can visually detect system states

Test 3: Display Output

* LCD shows basic messages such as:
  + “System Ready”
  + “Servo moving”
* Confirms Arduino can handle both display and control simultaneously

**Expected Results**

* Servo responds smoothly to MPU6050 input
* LED correctly indicates system state (power on, movement active)
* LCD provides real-time user instructions/feedback
* No overheating, miswiring or component failures during the test

**Next Steps after POC**

Once proof of concept is successful, the following will be added:

* Multiple servos (x4) for full robotic articulation
* Gripper mechanism with servo-controlled opening/closing
* RF transmitter and receiver for wireless communication between two Arduinos
* Buck converter and voltage regulation for battery power integration
* Optimized CAD design for robot body and servo placement

This proof of concept shows feasibility of the sensor-actuator-feedback loop, which is the foundation of our entire project