ENG. RAYAN ALSHALWI

DESIGN AND CONTROL OF A ROBOTIC ARM

USING A LINEAR ACTUATOR

1. SELECTING THE ROBOT TYPE

I CHOSE A ROBOTIC ARM FOR THIS EXPERIMENT, AS IT ALLOWS ME TO TEST THE LINEAR ACTUATOR'S ABILITY TO MOVE THE ARM UP AND DOWN WITH PRECISION AND STABILITY. ROBOTIC ARMS ARE WIDELY USED IN APPLICATIONS SUCH AS MANUFACTURING AND OBJECT MANIPULATION, MAKING THIS EXPERIMENT VALUABLE IN ASSESSING THE ACTUATOR'S EFFICIENCY IN CONTROLLED MOTION

2. CHOOSING THE APPROPRIATE MOTOR

SINCE I REQUIRE LINEAR MOTION, I SELECTED A LINEAR ACTUATOR, WHICH PROVIDES SMOOTH MOVEMENT FORWARD AND BACKWARD OR UP AND DOWN. COMPARED TO ROTATIONAL MOTORS LIKE STEPPER MOTOR OR DC MOTOR, THE LINEAR ACTUATOR OFFERS BETTER CONTROL OVER THE EXACT DISTANCE TRAVELED, MAKING IT IDEAL FOR THIS APPLICATION. ADDITIONALLY, IT CAN HANDLE DIFFERENT LOADS DEPENDING ON ITS POWER, MAKING IT SUITABLE FOR TASKS THAT REQUIRE LIFTING OR MOVING MECHANICAL PARTS STEADILY

3. CONNECTING THE LINEAR ACTUATOR TO THE ROBOTIC ARM

COMPONENTS USED

- LINEAR ACTUATOR TO PROVIDE THE REQUIRED MOTION FOR THE ROBOTIC ARM
- ARDUINO FOR CONTROLLING THE ACTUATOR'S OPERATION
- MOTOR DRIVER (L298N) TO REGULATE THE POWER FLOW TO THE ACTUATOR
- POWER SUPPLY SUITABLE FOR THE SYSTEM'S REQUIREMENTS

CONNECTION STEPS

I CONNECTED THE LINEAR ACTUATOR TO THE MOTOR DRIVER TO ALLOW CONTROLLED ACTIVATION. THEN, I LINKED THE MOTOR DRIVER TO THE ARDUINO TO SEND CONTROL SIGNALS FOR MOVEMENT. FINALLY, I PROVIDED AN ADEQUATE POWER SUPPLY TO ENSURE SMOOTH OPERATION

4. PROGRAMMING THE ROBOTIC ARM

I PROGRAMMED THE SYSTEM TO CONTROL THE ACTUATOR'S MOVEMENT FORWARD AND BACKWARD, ENABLING THE ROBOTIC ARM TO LIFT AND LOWER ACCORDINGLY. THE CODE INCLUDED DIGITAL COMMANDS TO MANAGE THE DIRECTION AND STOP THE ACTUATOR WHEN NEEDED, ENSURING PRECISE CONTROL OVER THE ARM'S MOTION

5. TESTING THE ROBOTIC ARM WITH THE LINEAR ACTUATOR

AFTER RUNNING THE PROGRAM, I OBSERVED THAT THE LINEAR ACTUATOR PERFORMED AS EXPECTED. WHEN THE FIRST CONTROL SIGNAL WAS ACTIVATED, THE ACTUATOR MOVED FORWARD, RAISING THE ROBOTIC ARM. WHEN THE SECOND SIGNAL WAS TRIGGERED, THE ACTUATOR MOVED IN THE OPPOSITE DIRECTION, LOWERING THE ARM. WHEN BOTH SIGNALS WERE TURNED OFF, THE ACTUATOR STOPPED COMPLETELY. THE SYSTEM RESPONDED QUICKLY AND MOVED SMOOTHLY ACCORDING TO THE PROGRAMMED INSTRUCTIONS

NEEDED FOR LIFTING HEAVIER LOADS. ADDITIONAL SENSORS COULD BE INTEGRATED TO IMPROVE POSITION ACCURACY AND AUTOMATION

6. ANALYSIS AND CONCLUSION

SUCCESSFUL ASPECTS

THE LINEAR ACTUATOR EFFICIENTLY MOVED THE ROBOTIC ARM ACCORDING TO THE PROGRAMMED INSTRUCTIONS. THE CONTROL WAS PRECISE AND COULD BE ADJUSTED EASILY TO MEET DIFFERENT REQUIREMENTS. THE SYSTEM REMAINED STABLE, WITH NO POWER OR OPERATIONAL ISSUES

AREAS FOR IMPROVEMENT

THE SPEED OF THE ACTUATOR COULD BE ADJUSTED FOR SMOOTHER MOTION BY USING PWM CONTROL INSTEAD OF DIRECT ON/OFF COMMANDS. A MORE POWERFUL LINEAR ACTUATOR MIGHT BE NEEDED FOR LIFTING HEAVIER LOADS. ADDITIONAL SENSORS COULD BE INTEGRATED TO IMPROVE POSITION ACCURACY AND AUTOMATION

7. CONCLUSION

BY USING A LINEAR ACTUATOR, I SUCCESSFULLY DESIGNED A ROBOTIC ARM CAPABLE OF EXECUTING CONTROLLED MOVEMENTS RELIABLY. THE ACTUATOR WAS AN EXCELLENT CHOICE FOR THIS APPLICATION, PROVIDING PRECISE LINEAR MOTION WITHOUT REQUIRING COMPLEX ANGLE CALCULATIONS LIKE ROTATIONAL MOTORS. MOVING FORWARD, I CAN FURTHER ENHANCE THIS PROJECT BY INTEGRATING SENSORS AND REFINING THE PROGRAMMING FOR EVEN MORE PRECISE AND AUTOMATED CONTROL