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| **Course Name:** | **Sensors in Augmented and Virtual Reality** | **Semester:** | **IV** |
| **Date of Performance:** |  | **Batch No:** |  |
| **Faculty Name:** | **Ms. Megha Sharma** | **Roll No:** | **16010320045** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** |  |

**Experiment No: 6**

**Title: Interfacing of Pneumatic Actuators**

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| **Aim and Objective of the Experiment:** |
| **To learn working of Pneumatic actuator** |

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| **COs to be achieved:** |
| **CO3: Understand advanced sensors and actuators used in Virtual reality hardware**  **CO4: Understand advanced sensors and actuators used in Augmented reality**  **CO5: Interface sensors and actuators to AR and VR systems** |

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| **Theory:**   * A pneumatic cylinder is a mechanical device that converts compressed air energy into a reciprocating linear motion. A double-acting cylinder uses compressed air to move a piston in and out, while a single-acting cylinder uses compressed air for one-way movement and a return spring for the other. They have numerous accessories, like sensors to detect the position of the piston and different mounting accessories to mount the cylinder or add components to the end of the piston. A wide range of industries requiring linear motion use pneumatic cylinders since they are simple to use and are a cost-efficient solution. They are also referred to as air cylinders.     Pneumatic cylinder working principle  Double-acting pneumatic cylinder  Double-acting pneumatic cylinders are the most common type since they give the user complete control of the piston movement. Figure 3 shows how the piston and piston rod move when compressed air enters the cap-end port and the rod-end port. A negative position is when the piston rod is retracted, and a positive position is when the piston rod is extended. When compressed air enters the cap-end port, it pushes the piston forward (positively), extending the piston rod (shown in Figure 3 A). Air is forced out of the rod-end port. To retract the piston rod, compressed air enters the rod-end port, forcing air out of the cap-end port, and forcing the piston to retract to the negative position (shown in Figure 3 B).  Double-acting cylinder working principle  Figure 2: Double-acting cylinder working principle with air going in (blue arrow) and air coming out (grey arrow). The left image shows positive movement (A). The right image shows negative movement (B).  Double-acting pneumatic cylinders allow the user full control, longer piston stroke length, and a constant output force through the entire stroke. They can also operate at higher cycling rates. However, a double-acting cylinder should not be used if the application requires a base position during fail-safe scenarios encase there is a loss in compressed air. Since they use compressed air for both directions, they also use more energy  Double acting pneumatic cylinder in use in a pick and place application  Figure 3: Double-acting cylinders can be used in a wide variety of ways, here we see a vacuum pick and place application that uses a pneumatic cylinder to move the position of the suction cup.  Single-acting pneumatic cylinder  A single-acting pneumatic cylinder only uses compressed air to drive the piston in one direction. A mechanical spring moves the piston in the opposite direction. Figure 4 shows the two design possibilities. Either the spring extends (Figure 4 A) or retracts (Figure 4 B) the piston. Single-acting cylinders are often used for fail-safe applications where it is required that the piston is in a certain position upon compressed air loss. Therefore, single-acting pneumatic cylinders have a "base" position.  Due to the mechanical spring, single-acting pneumatic cylinders do not provide a consistent output force throughout the full piston stroke length due to the opposing spring force. Furthermore, the stroke of single-acting cylinders is limited due to the space of the compressed spring. Therefore, the construction length of single-acting cylinders is longer than the actual stroke length.  Single-acting pneumatic cylinder working principle  Figure 4: Single-acting pneumatic cylinder working principle. Compressed air is used to move the piston in one direction, and a spring either extends the piston (A) or retracts it (B). |

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| **Stepwise-Procedure:** |
| Connect Pneumatic Circuit as per diagram |

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| **Output:** |
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| **Results:** |
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| **Post Lab Subjective/Objective type Questions:** |
| 1. Explain how Pneumatic cylinders can be used in ARVR   Pneumatic cylinders can be used in devices like VR chair or VR cave where we need to  simulate movement in order to make the users actually feel like they are moving in response to  whatever is playing on screen. It can be used in any device or place where we need to connect the  real world and virtual world via movement. |

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| **Conclusion:** |
| We successfully connected the pneumatic cylinders and saw how the pistons work using the air  pressure. |

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| **Signature of faculty in-charge with Date:** |