SI No.	Description of items	Quantity
PUR/52/ADA/AP/E/2021-22		
1.	**PROGRAMMABLE ANTHROPOMORPHIC ROBOTIC HAND** **(Details specifications are as per below ANNEXURE-I)**	01 No.

1. DELIVERY PERIOD (GOODS & SERVICES)

1.1. The ordered goods are to be delivered at CSIR-CMERI, Durgapur, West Bengal within 90 days from the receipt of Purchase Order.

2. WARRANTY

2.1. 01 (ONE) year warranty will be provided by the supplier from the date of acceptance of ordered goods. 01 year free support, including parts and labour (return to base excluded), unlimited email, Skype and phone support. After 1 year unlimited email support.

3. TRAINING

3.1 Online Training for operation, programming and user level maintenance/diagnosis of the system will be provided by the supplier.

4. PERFORMANCE SECURITY

4.1 Performance Security @3% of Contract/invoice value is to be furnished by the supplier within 21(twenty-one) days from the date of Purchase Order and it should remain valid for a period of 60 (sixty) days beyond the date of warranty period.

5. BID SECURITY DECLARATION

5.1 Bid Securing Declaration in Company's Letter Head and duly signed by the authorized personal of the Bidder shall be provided by the supplier.

1. REQUIREMENT OVERVIEW

This section briefs the high-level requirement for supply and operation / programming / training of a human-sized, programmable, anthropomorphic robotic hand (left handed) at CSIR - CMERI, Durgapur.

The robotic hand comprises a central body (palm) from which four or five fingers spread out in an anthropomorphic fashion. The wrist end of the hand allows mechanical attachment to a platform or to the wrist of a robotic arm.

The robotic hand should be able to able to grasp a variety of objects and to sense them through multiple force and position sensors. The hand is to be used as slave for dexterous remote handling tasks in both controlled and preprogrammed mode in a force feedback setup. The detailed specifications of the hand are mentioned in Sl. No. 3.
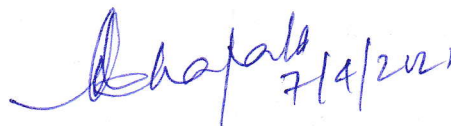
2. SCOPE OF SUPPLY

The following Products and Services are to be provided by the vendor:

Products:

- 4 or 5 Fingered anthropomorphic robotic hand (Left)
- SDK, Console application
- Force sensing kit (if not embedded with the hand)
- Accessories

Services:

- Product documentation including usage and programming manuals and operation and troubleshooting guides.
- Training to the CSIR - CMERI team for Operation, programming and user level maintenance of the system.

Annexure-I

3. ROBOTIC HAND SPECIFICATIONS

1.		**Fingers**	
a.	Count	4 or 5 human-sized fingers including one opposing finger (thumb)	
b.	Degrees of Freedom (DOF) [joints]	• Fingers: At least two DOFs (1 MCP and 1 PIP) in each finger • Thumb: At least three DOFs (2 MCP and 1 PIP) in thumb • Total: at least 9 DOFs	
c.	Degrees of Actuation (DOA)	• Independent Flexion/extension and adduction/abduction of opposing finger (thumb) (2 DOA) • Independent flexion/extension of index and middle fingers. (1 DOA each) • Independent or simultaneous flexion/extension of ring and/or little fingers (1 DOA combined or each) • Total: at least 5 DOAs	The open and close of ring and little fingers may be coupled together, but each finger should adapt on the object
d.	Range of motion	MCP joint: 90 deg PIP joint: 110 deg	
e.	Under actuated fingers automatically wrap around objects		
f.	Adjustable stiffness at joints not having directly mounted drives		
g.	Actuation type	DC motors with non-back-drivable mechanism	Failsafe, object should remain secure without power
h.	Transmission	Direct mounted at joints or tendons and Bowden cables	
i.	Speed	Full flexion from full extension : 1 sec or faster Full abduction from full adduction : 1 sec or faster	
2.		**Features**	
a.	Payload	4 kg or more	
b.	Weight	Up to 1.2 kg	Including all actuators, mechanics and electronics.
c.	Dexterity	Ability to grasp variety of objects.	

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3.	Communication / Interfacing		
a.	User configurable CAN (333 Hz or more) or USB compatible RS232 protocol based communication		
b.	Should be compatible with MS Windows.		
4.	Sensory system		
a.	Position	Position sensing on each active axis Type: Digital encoder or potentiometer Resolution: 0.005 deg or lower	
b.	Grasp force	Tendon or fingertip force sensing on thumb, index, middle and ring fingers. Resolution: 10 bit or better	
5.	Embedded Controller		
a.	Real-time control	Position, Current/torque for each axis, 333 Hz or better	
b.	Preset grasps	Multiple ready-to-use/pre-programmed grasping algorithms	
6.	Modes of operation		
a.	Preprogrammed mode	With at least 4 preset grasps	
b.	Programmable mode	Should allow giving commands to independently set the target position on all the axes. An SDK should be provided.	

4. ACCEPTANCE TEST

- Successful preliminary operation of preprogrammed tasks and completion of training.

5. WARRANTY AND SUPPORT

- 1 year free support, including parts and labor (return to base excluded), unlimited email, Skype, and phone support.
- After 1 year, unlimited email support.

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