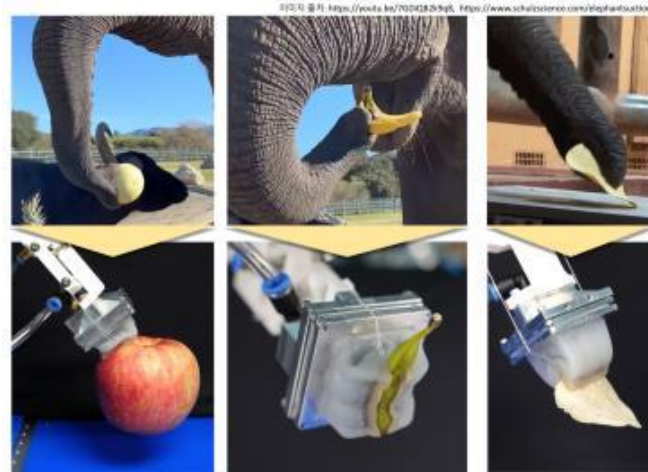


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## KIMM Develops the World's First Elephant Trunk-mimetic Robot Hand, Capable of Gripping Even Fine Needles

- KIMM develops a gripper that mimics an elephant's trunk to pinch and attach to objects at the same time -
- Able to grip objects of various sizes by pinching or attaching to objects with a single gripper -

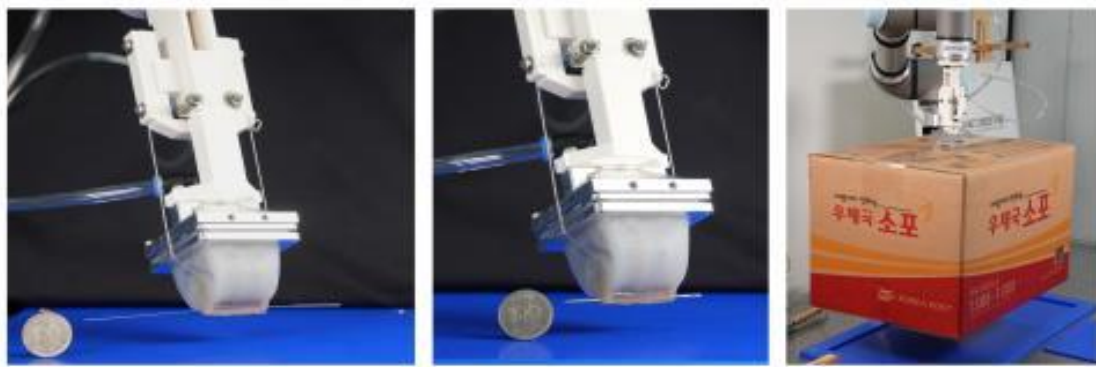
- ☐ A gripper robot has been developed that can grasp all types of objects, from very fine or thin objects such as acupuncture needles and sewing needles to large objects such as boxes.
- ☐ The Korea Institute of Machinery and Materials (President Sang Jin Park, hereafter referred to as KIMM), an institution under the jurisdiction of the Ministry of Science and ICT, announced that it has developed the world's first gripper capable of all gripping movements, inspired by elephant trunks. Specifically, it mimics how elephants pick up small objects by pinching them with the tip of their trunks or grip the large objects by sucking in air deeply through their trunks.



<Comparison of how elephants and the gripper grip various objects>

- The research team led by Dr. Sung-Hyuk Song, a senior researcher at the Department of Robotics and Mechatronics in the KIMM AI Robot Research Division, developed an elephant trunk-mimetic gripper that can grip object with pinch-suction fusion mechanism using its soft structure, stretchable-thin wall, and wires that allow the gripper to change its shape. The team expects this new technology to be applicable to various fields, for it is not only able to effectively transport various size of objects, but also is capable of gripping and assembling objects in a stable manner, without the use of any complicated mechanical devices or sensors.
- The soft structure of the gripper has several micro-channels that create a vacuum inside, helping it attach to an object. Since each of these micro-channels is flexible, it can modify its shape to match that of objects it comes into contact with. Therefore, the soft structure itself functions as a suction gripper by generating adhesive force to surface of objects.
- In addition, by pulling the wires that control the shape of the gripper, located in the center of the soft structure, the gripper can fold in half on itself, which allows for it to be used like a claw gripper, pinching and grasping the objects. When used in this way, the stretchable-thin wall located outside the gripper wraps around and seals the target object. By creating a vacuum inside the gripper after pinching and wrapping around the object, the gripping force can be greatly increased as needed.

- Over the years, the grippers have been developed separately as a claw type or a suction type. Claw-type grippers cannot grasp objects that are larger than the maximum size at which the claw can be opened. Meanwhile, suction-type grippers are capable of gripping objects of various sizes, but struggle when gripping very thin objects such as needles or thread, or objects such as cloth or sponge that the air can pass through.
- The gripper newly developed by KIMM can grip objects of various sizes and materials by simultaneously applying the claw-type and suction-type gripping mechanisms. It is not only capable of gripping small-size objects, such as acupuncture needles (0.25mm in diameter) from the floor, which are smaller than one hundredth the size of the gripper, but it also can grip large-size objects such as boxes that are 10 times its size.



<The gripper gripping objects of various sizes>

- Also, this gripper can pinch and grasp various objects in claw gripping mode by simply turning on and off the pneumatic cylinder that moves the shape-modifying wires, without any complicated sensors or controls. Dr. Sung-hyuk Song explained, “After contacting the soft gripper to the floor and then creating a vacuum while conducting a pinching motion, the gripper can grip objects as if you were strongly pinching the floor with your fingers. In this way, even very thin objects can be easily gripped and be lifted from the floor.”
- With the advantages of KIMM’s new technology, the gripper can even conduct complex tasks, such as preparing for a party by wrapping a doll in a gift box, inserting a paper cake topper into

the cake, and stably holding matches on the floor to light candles. The gripper can even arrange flowers by grasping the stems of various flowers with atypical shapes lying on the floor.



<The gripper after finishing party preparations and the flower arrangement>

- Dr. Chanhun Park, the Director of AI Robot Research Division, explained, “Our newly developed elephant trunk-mimetic pinch-suction fusion gripper, which uses both claw and suction mechanisms, is soft, so there is no risk of injury even when operating it around people. Not only can it handle objects of various sizes, from fine parts to boxes, without complex mechanical structures or sensors, but also it can be handled easily, which means it can be applied to various industries as well as daily life.” He added, “I expect it to be of great help to the development of service robots in daily life and companies that produce a variety of different objects.”

### **[List of Attachments]**

- Attachment 1: Photos of the elephant trunk-mimetic, pinch-suction fusion gripper (photos)
- Attachment 2: Demonstration videos of the elephant trunk-mimetic, pinch-suction fusion gripper (attached separately)

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**The Korea Institute of Machinery and Materials (KIMM) is a non-profit government-funded research institute under the Ministry of Science and ICT. Since its foundation in 1976, KIMM is contributing to economic growth of the nation by performing R&D on key technologies in machinery and materials, conducting reliability test evaluation, and commercializing the developed products and technologies.**

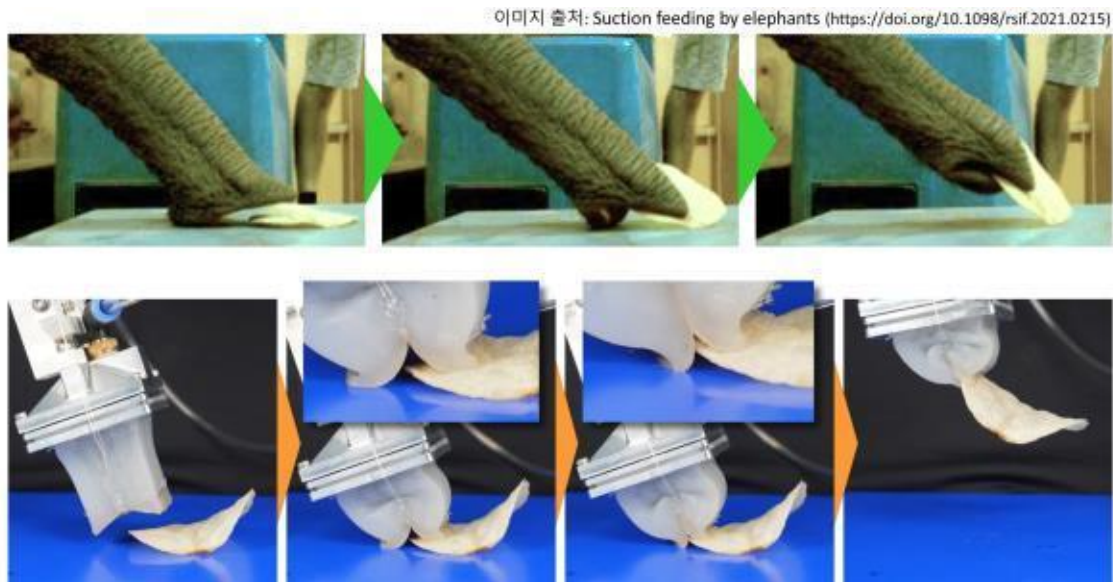
These research efforts were carried out with the support from the “Smart End Effector for an All-in-One Robotic Working System” project, a fundamental project at KIMM.

**Credit :** The Korea Institute of Machinery and Materials (KIMM)

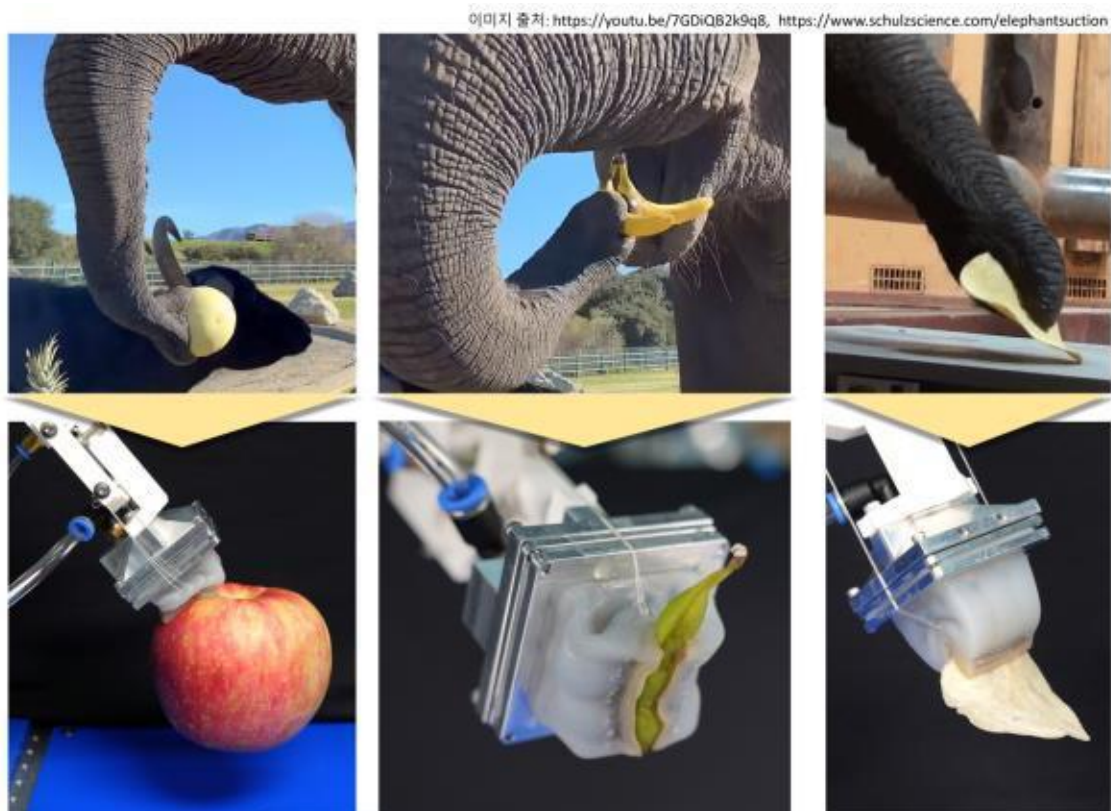
**Usage Restrictions of Multimedia (Attachment File) :** The sources of photos and research results from KIMM must be specified.



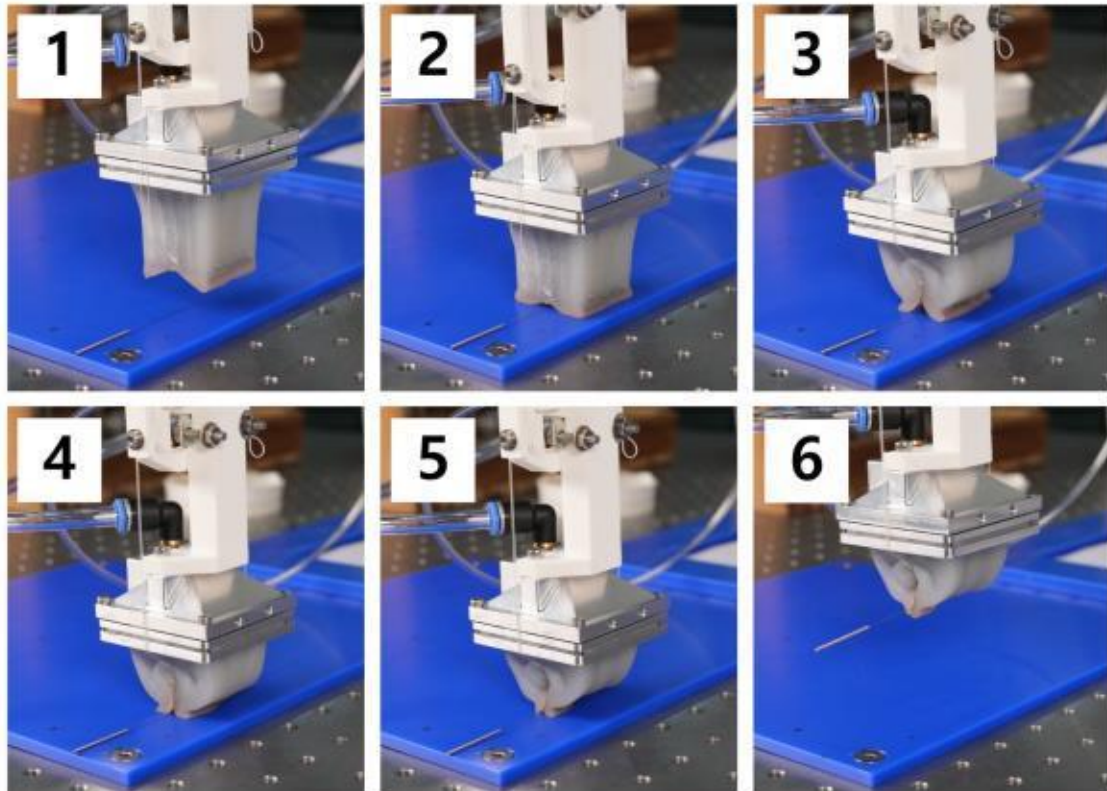
- Attachment 1: Photos of the elephant trunk-mimetic, pinch-suction fusion gripper (photos)



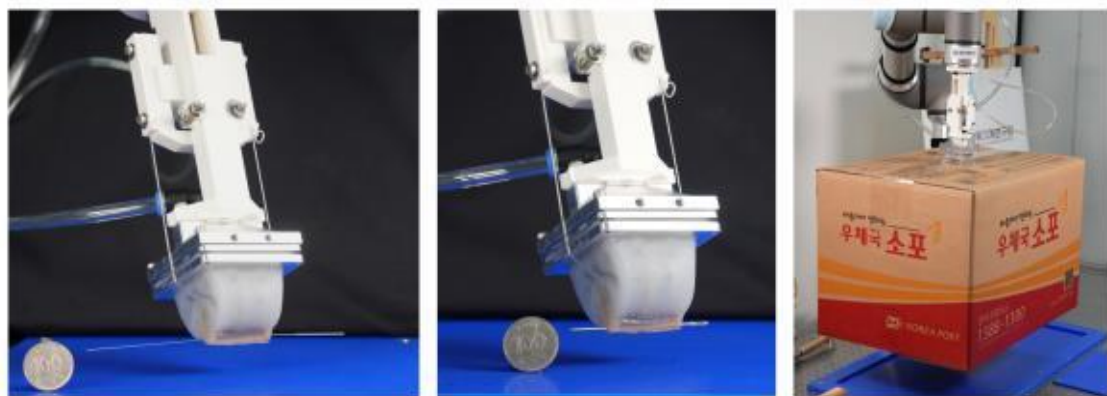
Description: Comparison of an elephant and the gripper gripping potato chips.



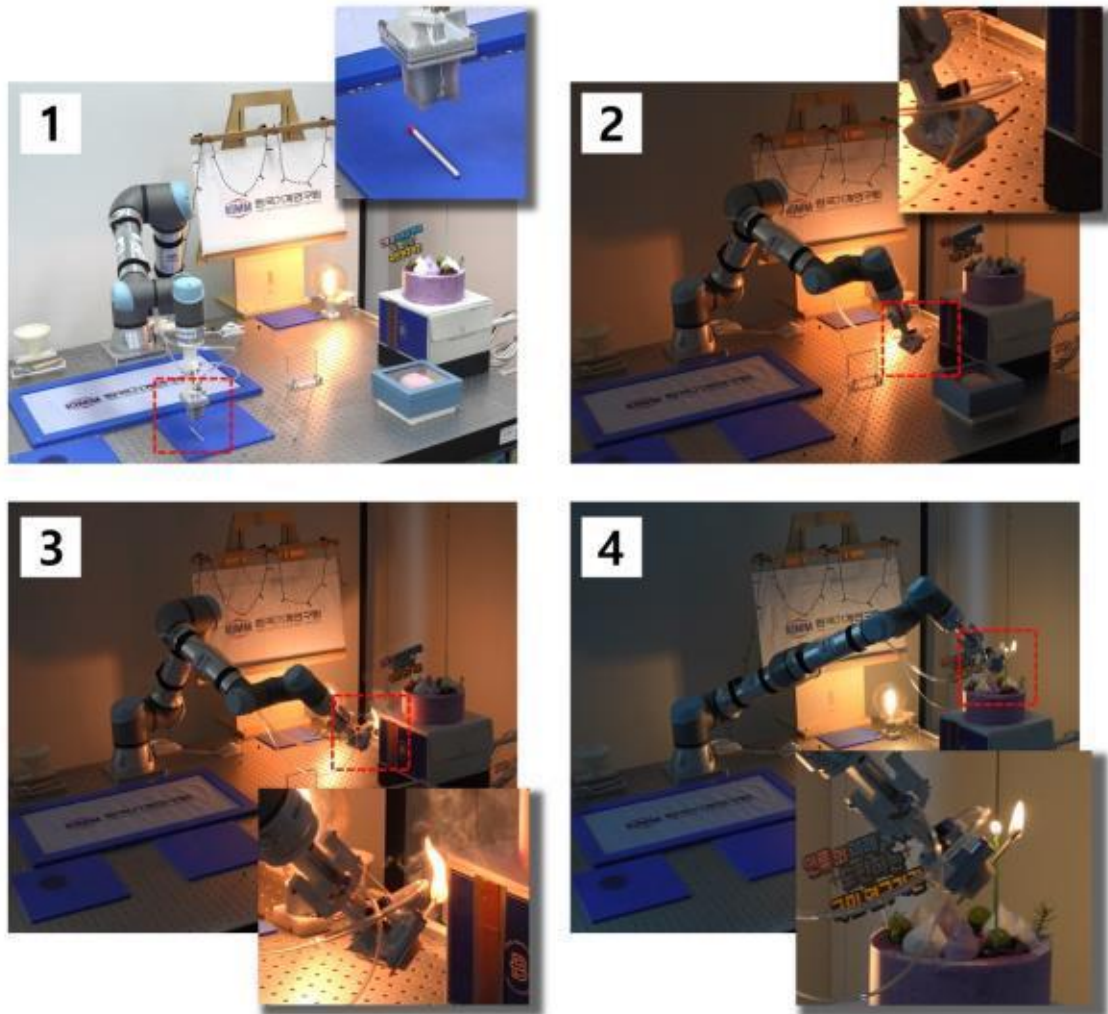
Description: Comparison of how elephants and the gripper grip various objects.



Description: The gripper is used to grip an acupuncture needle placed on the floor. In the gripping process, the tip of the gripper bends like a finger, comes in contact with the floor, and then picks up the acupuncture needle.

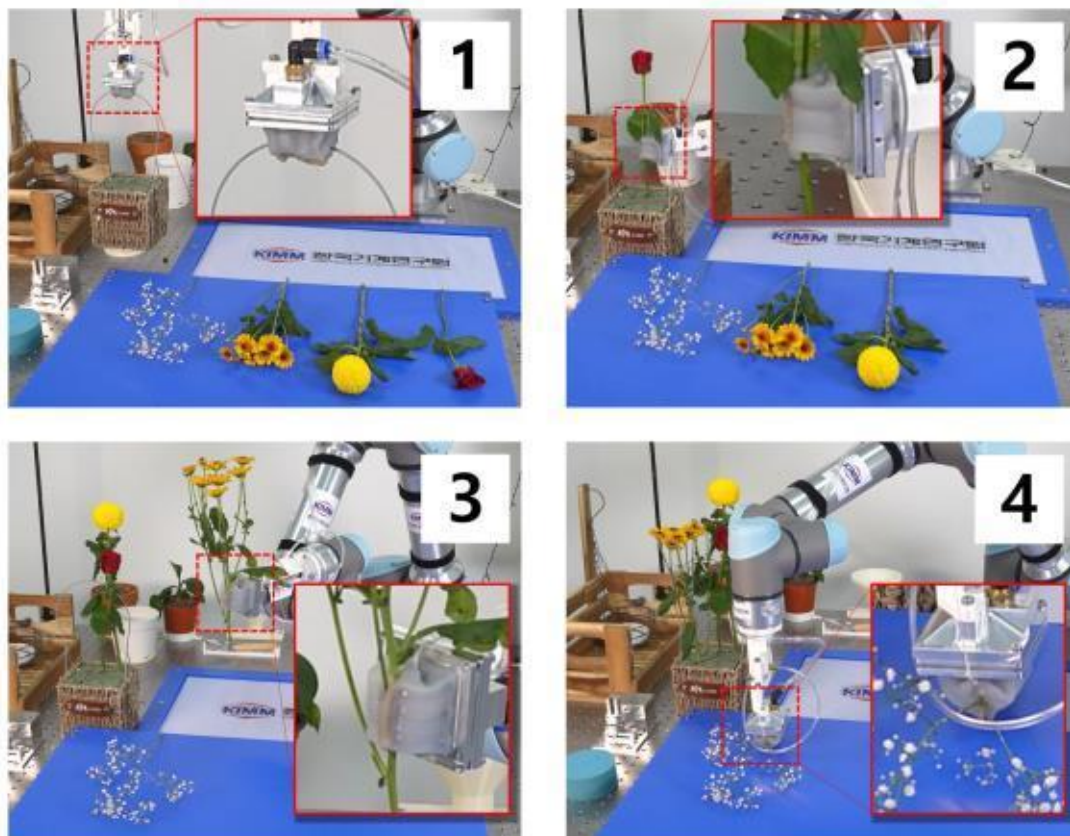


Description: The gripper gripping objects of various sizes.



Description: The gripper preparing for a party. After wrapping a gift by putting the doll in a box, the gripper grabs the fabric and hangs it on the easel. It then grabs the electric wire of the small light bulb and puts it on the easel, lights a large light bulb, puts a cake topper and candles on the cake, and lights the candles.

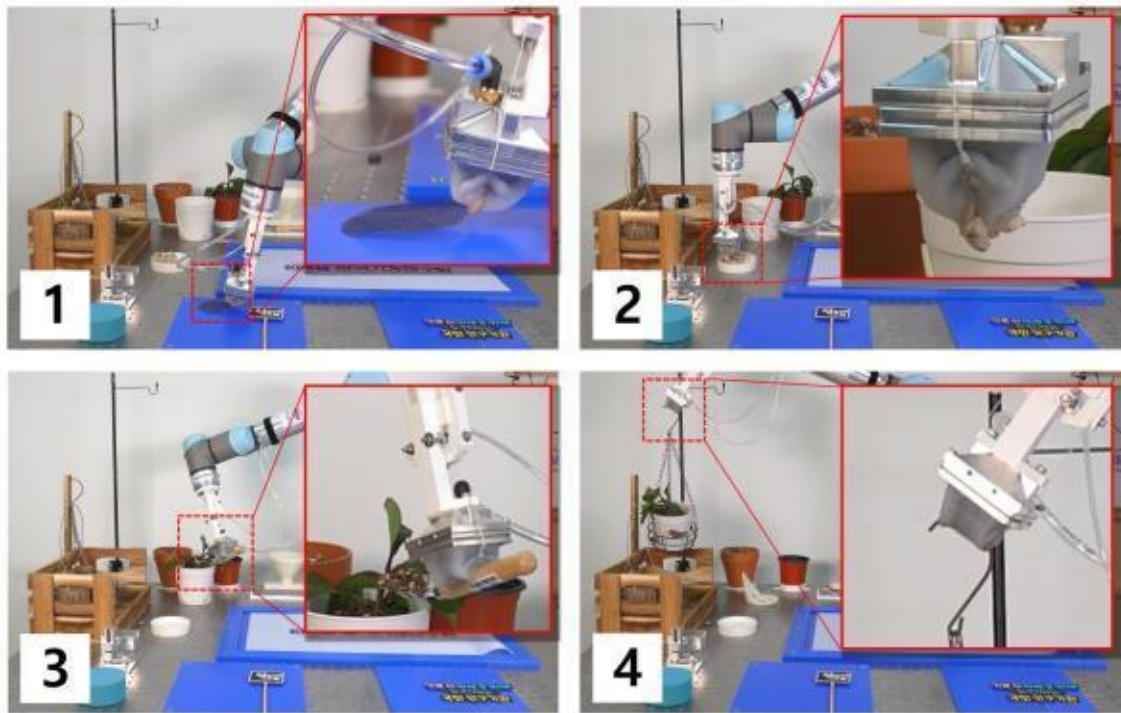




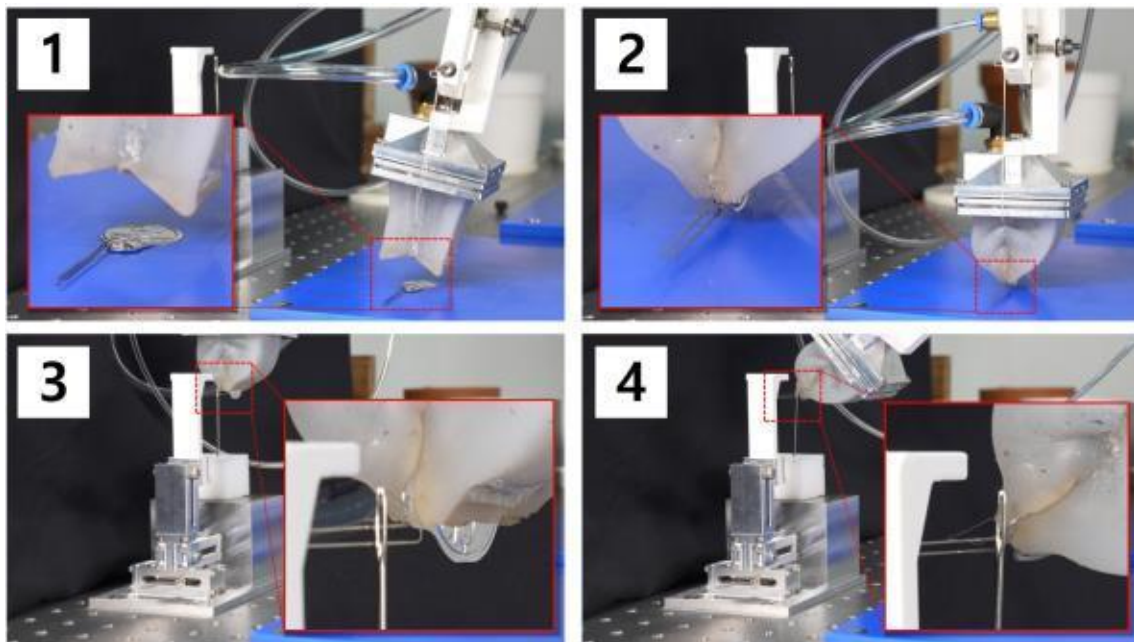
Description: The gripper arranging flowers. The gripper grips flower stems of various thicknesses and shapes through a stable pinching motion and then inserts them into a flower basket. Even when gripping flower stems of various shapes and thicknesses that are lying on the floor, the gripper can apply a strong gripping force and insert them into the basket without damaging the flower stems.



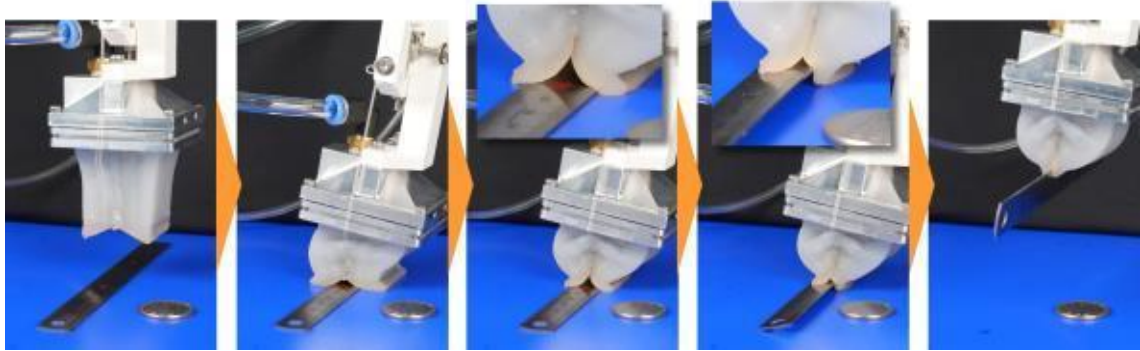
Description: The gripper after finishing party preparations and the flower arrangement.



Description: A photo of the gripper potting plants.



Description: The gripper holds the needle threader placed on the floor upright, precisely threads it through the eye of the needle, and then rotates it.



Description: The gripper gripping a metal ruler, which is thinner than half the thickness of a coin and thus difficult even for a person to grip, placed on the floor and lifting it at a 90-degree angle.

- **Attachment 2: Demonstration videos of the elephant trunk-mimetic, pinch-suction fusion gripper (attached separately)**