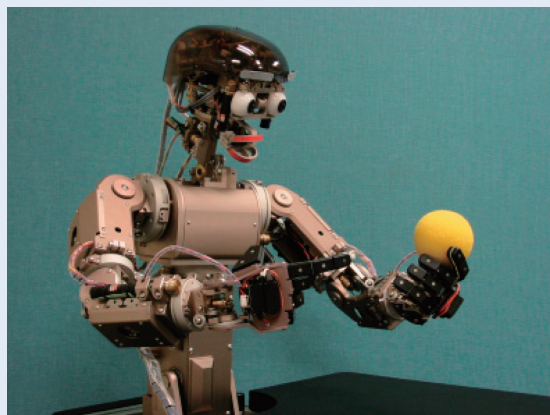


Patent No. 3538637

## Mechanism and Driving Method for Robot Lips

Invented by : *KOZIMA Hideki*

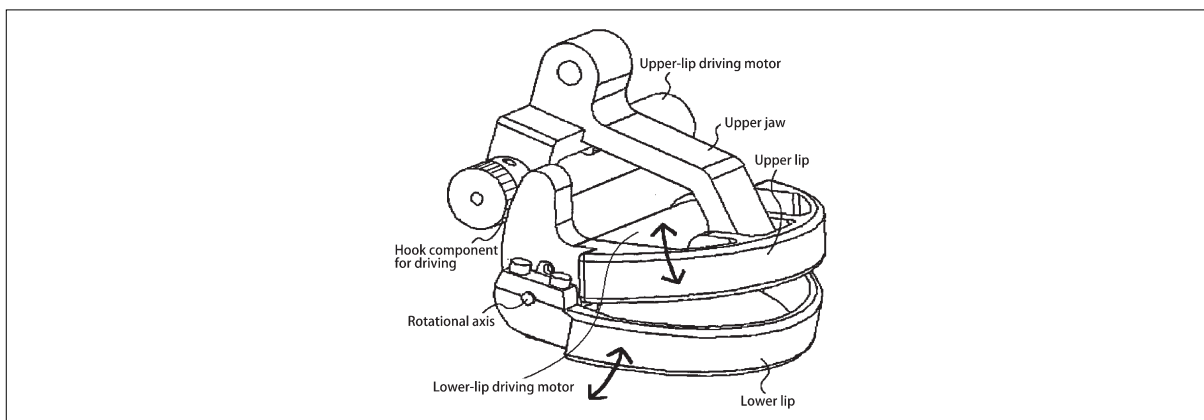


"Infanoid" Communication Robot

### Overview of technology

The movement of lips has an important role in the formulation of various expressions in a humanoid or animal robot. Of course, the relationship with other components of the face such as the eyes and eyebrows is also important, and the combined movement of these components ultimately forms expressive facial signals. The current invention provides a mechanism for lips to make various expressions using a relatively simple structure with only two degrees of freedom.

If the upper and lower lips are independently driven with motors or similar devices around a rotational axis at the back joint between the lips, the distance between the upper lip and the eyes will be too narrow. It will destroy the balance between the positions of the lips and the other components of the face such as the eyes and the nose and will not be able to produce natural, expressive facial signals. The current invention uses a rotational axis at the back joint between the lips as in the conventional method, but it also uses another rotational axis placed near the front edge of the upper lip, along the line of extension from the upper jaw. Around this front rotational axis, the upper-lip driving motor moves both the upper and lower lips upward or downward simultaneously. The lower-lip driving motor moves the lower lip upward or downward relative to the upper lip (i.e., opens or closes the lips) around the rotational axis at the back joint. In this manner, it is possible to move the entire lip structure upward or downward with the lips kept closed or opened. With this mechanism, we succeeded in making expressive facial signals, such as a smile and frown, with only two axes.



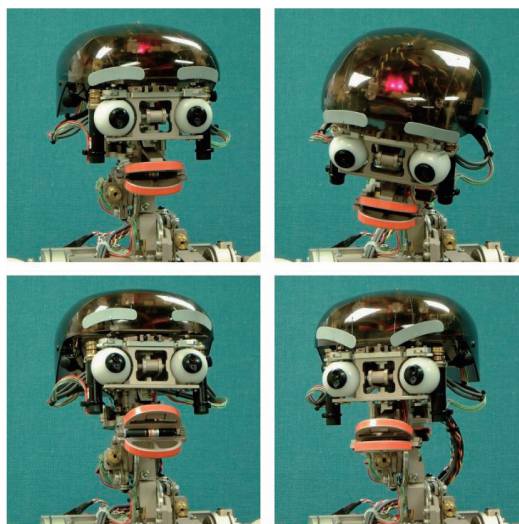
Schematic diagram

## “Infanoid” communication robot

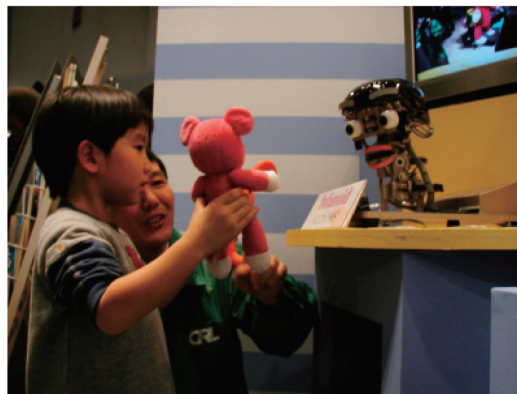
Infanoid was developed to study communications between robots and people. It is thus equipped with the capabilities necessary for communication. First, it has functions to talk and listen. Second, it can produce facial expressions using the eyes, eyebrows, and lips, processes to which the current invention is effectively applied. It can also talk while looking at the eyes of the person with whom it is communicating (i.e., making eye contact) and can move its head to look upward, downward, left, and right. It can move both arms and hands freely to express body language. It can hold an object in one hand while pointing at the object with the other hand with its eyes looking toward the object. As such, Infanoid is innovatively designed to communicate in a wide sense, not only through words. Among these communication capabilities, we have a patent (Patent No. 3650817) on the driving mechanism for the eyebrows, in addition to the current invention for the mechanism of the lips. “Infanoid” is also a registered trademark (No. 4638673).

### Commercialization

We have built multiple prototypes and performed numerous experiments to develop the current iteration of Infanoid. The first-generation Infanoid had an extremely simple structure, with two cameras corresponding to human eyes mounted on a tripod. Today, Infanoid is in its fifth generation of evolution. This Infanoid communication robot has been commercialized by International Vital Device Co., Ltd. Taking advantage of its expressive facial signals, Infanoid can play the “Look this way (acchi muite hoi)” game with a person. Infanoid judges whether it has won or lost a game and produces an expression of joy when it has won, as well as an expression of sorrow when it has lost. Its expressiveness corresponds precisely to that of a human being. If you happen to come across Infanoid at an exhibition, please interact with it to see for yourself.



Four emotive expressions  
(Upper left: joy; Upper right: sorrow; Bottom left: surprise; Bottom right: anger)



A child playing with the desktop version of “Infanoid” (The Third TBC Digital Yume World in Sendai City, 2003)

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