

Stuffed Toys Alive! : Cuddly Robots from Fantasy World

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1 Introduction

Stuffed toys live with all ages and hold them in some physical and mental aspects. With the soft feel and cute characters, stuffed toys play with them, sleep together and listen to their complaints. These roles of stuffed toys show that people imagine stuffed toys are interactive creature. Indeed, there are many stories and movies in which stuffed toys work as living characters. However, stuffed toys in real world are just dolls and they cannot move and react.

Animatronics, pets and social robots with skin of stuffed toys [Shibata and Tanie 2001][Stiehl et al. 2006] realize soft motion of creatures in our imagination world. However, they don't have soft feelings. It is known that "transitional object" for infants begins from soft object. The soft feel will be a cause for familiarity of stuffed toys. Thus, we propose a mechanism for stuffed toy type robots ("cuddly robots") which keep the soft feel of stuffed toys.

2 Innovation

The soft feel both on mechanics and motion in the proposed robot is realized by three innovations;

Driving mechanism retaining nature of stuffed toys

The arms, legs and a head are soft to bone. They consist of strings, cotton wool and cloth, and have no hard materials. The sack of cloth is inflated by the pressure from the internal cotton wool. The string is connected to the end of the sack and be sewed to the opening of the sack. Then the other side of the string is connected to a small winch placed in the center of the body where all hard mechanism is placed. The arms and legs have a good soft feel because they don't give sensation of any hard obstacles. In addition, they are robust to bending.

When bending, the driving mechanism makes natural soft curves on arms and legs and gives soft impression. These shapes give natural impression as stuffed toys because they are same to the shapes of the curves which are generated when we animate them by taking their hands and feet.

Motion control for the soft mechanism

Proposed mechanism has repeat accuracy enough to create a map between the hand position and lengths of strings. Reaching motions to any target positions are available and various interactions can be realized. The smooth acceleration and motions conscious on the elasticity of the cotton wool gives impression of natural motion of stuffed toys.

Force sensor with driving strings

With force sensors embedded in the winches, the driving strings work as tension sensor. They sense forces on arms, legs and a head and realize reactions to user's interaction. In addition, the tension sensors are accurate enough to realize impedance control. Interactions such as handshakes are realized by controlling target position of the motion based on the sensed force.



Figure 1: An example of touching interaction and appearance and inside of the cuddly robot. The cuddly robot is soft to the bone.

3 Exposition

When the stuffed bear (cuddly robot) notices the user approaching to him, he stretches his hand to attract attention of the user. Then, the user takes his hand and he moves his hand to correspond to the motion of the user. If the user puts and leaves him, he will writhe and struggle to get the user's favor until the user takes him up in the arms. Finally, the user holds him and he feels a relief and moves his hands up and down.

4 Vision

Recently, alternate reality and gamification, which embed storytelling and entertainments into our daily world, are getting public attention. We had proposed mixed reality installations such as "Kobito" or "Haptic Ring" which realize interaction with characters in the real world. However, getting a real body is ideal for haptic interaction for characters. Stuffed toys get into our daily lives. They have both bodies of real substances and their own story and fantasy world. Cuddly robot, which inherits these characteristics of stuffed toys, can be a new medium which entertains us in our daily lives and gives a sense of unity to our daily world and the fantasy world. Imagine the future, the stuffed toys from the fantasy world live with us and enchant our daily lives.

References

- SHIBATA, T., AND TANIE, K. 2001. Physical and affective interaction between human and mental commit robot. In *Proc. of ICRA 2001*, vol. 3, 2572 - 2577 vol.3.
- STIEHL, W. D., BREAZEAL, C., HAN, K.-H., LIEBERMAN, J., LALLA, L., MAYMIN, A., SALINAS, J., FUENTES, D., TOSCANO, R., TONG, C. H., AND KISHORE, A. 2006. The huggable: a therapeutic robotic companion for relational, affective touch. In *ACM SIGGRAPH 2006 Emerging technologies*.