SEER: Simulative Emotional Expression Robot

Takayuki Todo
Independent Artist
toodooda@gmail.com

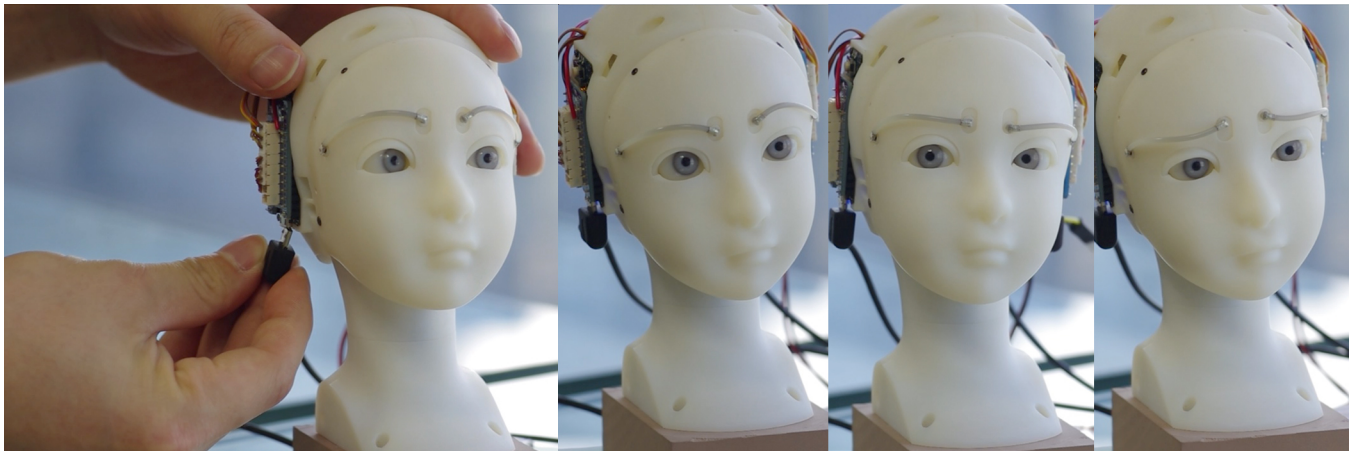

Figure 1: The first prototype of SEER is a bust up humanoid with palm-sized head.

ABSTRACT

SEER (Simulative Emotional Expression Robot) is an animatronic humanoid robot that generates gaze and emotional facial expressions to improve animativity, lifelikeness, and impresssiveness by the integrated design of modeling, mechanism, materials, and computing. The robot can simulated a user?s movement, gaze, and facial expressions detected by a camera sensor. This system can be applied to puppetry, telepresence avatar, and interactive automation.

CCS CONCEPTS

• **Human-centered computing** → *Interaction design theory, concepts and paradigms*; • **Hardware** → *Displays and imagers*;

KEYWORDS

humanoid robot,animatronics,facial emotional expression,gaze interaction,lifelikeness,uncanny valley

ACM Reference Format:
Takayuki Todo. 2018. SEER: Simulative Emotional Expression Robot. In *Proceedings of SIGGRAPH '18 Emerging Technologies.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3214907.3214921

SIGGRAPH '18 Emerging Technologies, August 12-16, 2018, Vancouver, BC, Canada

ACM ISBN 978-1-4503-5810-1/18/08.
https://doi.org/10.1145/3214907.3214921

1 INTRODUCTION

The purpose of my research and development is not to answer the philosophical theme "Will a robot (or computer) obtain a mind or emotions like mankind," but to portray the sense of conscious emotion such as a human can produce. I think it is possible to represent human-like communications by constructing an adequate interaction system between emotional sensing and expressions. If we understand and identify with robots which can learn the functions and usages of emotional expressions from inter-actions with people, get a good command of them accordingly with situations and context, could we distinguish them from the existence of those with real minds and emotions? As the first step to realize this, I thought two conditions were necessary: the eyes to detect the appearance of another's face, and the face to be made appealing to the users eye.

2 GAZE FIXATION SYSTEM

Each eyeball-part has a 2DOF (yaw, pitch) gimbal mechanism which makes the proper gaze direction to a target. The head has 3DOF orthogonal axis rotatability. Two vectors of eyeballs are controlled to focus on a certain point, even if the head is tilted on an axis, they keep fixation by coordinate transformation. This gaze fixation system:

- Enables gaze tracking and eye-contact interaction with people using the camera sensor.
- Divides the gaze target control and the head tilt control.
- Generates humorous expressions with the angle difference between the eyes and the face.
- Makes the robot look as if it's staring at something with its own sense of will and consciousness.

3 WIRE-BENDING EYEBROW MECHANISM

While the main housing is made of a rigid material, I applied flexible wire for the eyebrow as that accounts for a large part of the facial and emotional expressions. Each eyebrow-part has 3DOF mobility. This wire-bending eyebrow mechanism:

- Extracts the minimal, essential factors for emotional recognition.
- Emphasizes them as a hybrid of symbolic curve illustration and 3D real-world objects.
- Enables delicate gradual control and smooth animation with repeated precision (see Figure 2).
- Makes it easy to match the robot?s face with another?s with the use of a camera, this enables simulative facial inter-action with people.

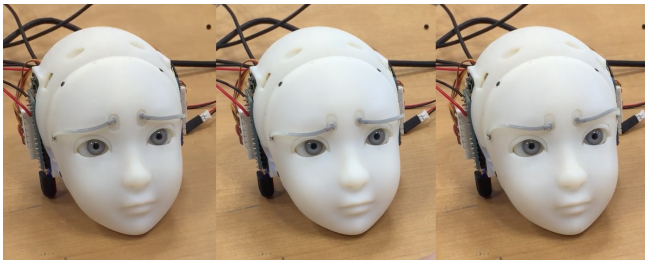

Figure 2: Gradual transformation from sad-looking face to angry-looking face.

4 CONCLUSION

I proposed a concept of SEER, then implemented a hardware prototype and core systems. This system is to be tested by participant experiments as a face-to-face interactive demonstration to evaluate its effectiveness. On this prototype, the "smiling" mechanism has yet to be implemented. I am designing it for the next prototype.

ACKNOWLEDGMENTS

This project is based on the author?s personal budget. I received a lot of technical support from Takanari Miisho and Yuki Koyama on software development.