Design and Implementation of an Interactive Animatronic System for Guest Response Analysis

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Within entertainment applications, animatronics must be identified as human partners to establish status for dynamic interactions for enhanced acceptance and effectiveness as socially-interactive agents. This research covers the design and implementation for human identification using a depth camera (Carmine from PrimeSense), an open-source middleware (NITE from OpenNI), Java-based Processing and an Arduino microcontroller into an animatronic dragon. The above diagram displays the control flow diagram for the interactive, animatronic system. The interactive behavior is the depth camera. The PrimeSense behavior is a closed loop system while passive behavior is open-loop.

Hypothesis

- A people-aware, autonomous, animatronic system can be designed for testing effectiveness of interactive animatronics.
- Interactive, animatronic behavior will be more entertaining than passive behavior.

Design and Fabrication

- The outputs of the dragon include a head with four degrees of freedom, moving jaw, blinking eyes, expanding wings, shifting tail and sound effects.
- The animatronic dragon, Kronos, was custom designed and fabricated for research purposes. The dragon sits atop a table that houses electrical and mechanical components. The table is approximately 32 inches deep and 42.5 inches in width. The dragon is affixed to the table; the majority of the motion capabilities are involved with the head and neck. This allows for the dragon to "watch" humans. Most of the hardware components were housed underneath the table in order to reduce mechanical noise and ease of maintenance and assembly.

Vision and Control

- To the left, is a screen capture of the program tracking the nearest pixel in the infrared image. A blue circle is drawn over the identified pixel.

Guest Feedback

- Small studies have been conducted with elementary school students and college students. No statistical difference was found between passive and interactive behaviors with the children. College students, without prior exposure to Kronos, ranked interactive behavior greater than passive.

Conclusion

- Kronos has been fully fabricated and implemented. Small improvements are being made to improve robustness and life cycle use of the entire system. Future work will include the integration of the system into a cloud robotic network and facial expression recognition.

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Want to see Kronos in action? Go to: thebrianburns.wordpress.com