Haptic and Virtual Reality Glove Comparison

Madison Quinn and Shane Taber

Engineering & Computer Simulations, Inc.

i³FEST

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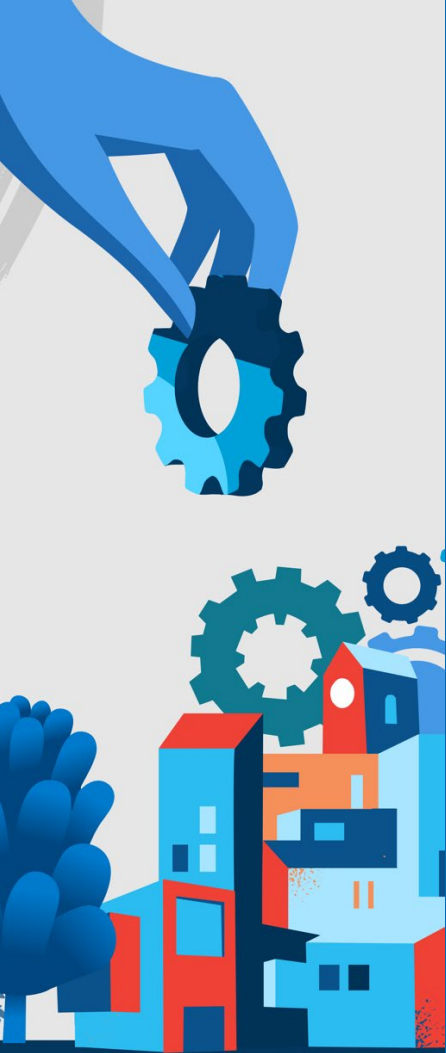
HAPTIC AND VIRTUAL REALITY GLOVE COMPARISON

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- Headquarters in **Orlando, FL**; with Operations in **Huntsville, AL** and **San Antonio, TX**
- Appraised CMMI Level 3

CMMI DEV /3℠

- The U.S. Army is interested in experimenting with haptic glove systems integrated with weapons and other immersive technologies in VR environments to increase realism during CUF performance assessments.
  - Multimodal Study Research 2016-2018
  - Haptics prototype 2018-2020
  - Advanced Haptics SBIR 2020-2022
- Considered Gloves
  - BeBop
  - SensoryX
  - VRgluv
  - AvatarVR
  - HaptX
  - Ultrahaptics

- BeBop's website:
  - Natural hand interaction
  - Providing haptic feedback
  - Lightweight/comfortable
  - Hand tracking
  - $10,000 per pair
    - (prices are subject to change)

VRGLUV ENTERPRISE

- VRgluv ENTERPRISE website:
  - Immersive touch
  - Realistic interactions in the VR
  - Increase training effectiveness
  - Force feedback of up to 10lbs
  - $9,000 per pair
    - (prices are subject to change)

- HaptX gloves website:
  - Haptic feedback
    - Uses microfluidic skin that gives true-contact haptics.
  - 40lbs per hand of force
  - The gloves currently cover the entire hand and forearm.
  - $80,000 per pair
    - (prices are subject to change)

RESULTS

0 –N/A to me; 1 – Strongly disagree; 2 – Disagree; 3 – Agree; 4 – Strongly Agree	BeBop Gloves (n=5) Mean (*SD*)	VRgluv Gloves (n=2) Mean (*SD*)	HaptX Gloves (n=4) Mean (*SD*)
I was comfortable with the gloves on my hands.	2.40 (1.02)	3.00 (0.00)	3.50 (0.50)
My fingers had freedom to move while wearing the gloves.	3.00 (0.63)	3.00 (0.00)	3.25 (0.43)
The gloves were manageable to use	2.40 (1.02)	3.50 (0.50)	3.00 (0.00)
The gloves were intuitive to use.	2.80 (1.17)	2.50 (0.50)	4.00 (0.00)
The gloves fit well.	2.25 (0.83)	3.50 (0.50)	3.50 (0.50)
The gloves had adequate force feedback.	2.20 (0.75)	2.50 (0.50)	3.25 (0.43)
The gloves were light weight.	3.40 (0.80)	2.00 (0.00)	2.25 (0.43)
The Integration of the glove functioned as intended	2.00 (1.26)	2.50 (0.50)	3.25 (0.43)
I would recommend the gloves for future research projects.	1.80 (0.75)	2.00 (0.00)	3.75 (0.43)

DISCUSSION

	Benefits
BeBop	• Gloves have a charge life of four to five hours • Gloves are not tethered
VRgluv	• Gloves are not tethered • Provides excellent haptics • Easy to hold weapon with • Gloves hold a charge of two to three hours
HaptX	• Gloves do not require charging because they are connected to system • Includes a backpack mode (could be beneficial in a CUF scenario) • Does not require calibration (just a quick hand scale for display) • Provides excellent haptic feedback

DISCUSSION

	Concerns
BeBop	• Requires calibration every time scenario is started • Difficult time connecting to the system • Fingers jitter back and forth in VR • Uncomfortable (hands and fingertips) • Strap across the back of each of finger is constraining
VRgluv	• Heavier and blocky gloves • Software development toolkit needs to be improved • Gloves make a particular noise that could affect the realism of the environment • Hold a charge for about two to three hours
HaptX	• Heavier gloves • Thimbles on the fingers and thumbs cause an issue with grabbing virtual items • System needs to be restarted periodically to avoid issues with compressive system • Tethered gloves • Difficult to use certain weapons due to the magnetic tracking in the gloves

- Comparison to Consumer feedback

- Additional data collection events & more participants

- Different configurations / use cases

- Updates for new glove versions & new systems

QUESTIONS
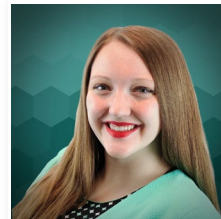
Madison Quinn

Research Analyst

mquinn@ecsorl.com

407-823-9991

Shane Taber

Chief Technology Officer

shanetaber@ecsorl.com

407-823-9991

ENGINEERING & COMPUTER SIMULATIONS
ORLANDO HEADQUARTERS
11825 HIGH TECH AVENUE, #250, ORLANDO, FL 32817

HUNTSVILLE OFFICE
4100 MARKET STREET SW, #100, HUNTSVILLE, AL 35808

Contact us via phone or email at 407.823.9991 | **info@ecsorl.com**

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