A Browser-Embedded XR Simulation Model for Experiential Animal Behavior Training in Online STEM Education

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ABSTRACT

Online courses often rely on static materials such as readings and recorded lectures, which limit opportunities for experiential learning. This challenge is more pronounced in animal behavior education, where students must interpret subtle cues and environmental context. In fully online settings, access to real environments and live animals is limited, and repeated use of animals raises safety and ethical concerns.

This project presents a browser-based, XR-ready simulation that allows users to explore a virtual veterinary clinic and switch between human and canine perspectives. The system runs directly in a web browser without requiring specialized hardware, improving accessibility across devices. The design focuses on performance, usability, and adaptability for online learning environments.

BACKROUND

- *Online learning often limits hands-on experience*
- *Animal behavior requires observation and context*
- *Access to real environments is restricted*
- *Ethical and safety concerns with live animals*
- *Need for scalable, accessible solutions*

APPLICATION IN EDUCATION

- *Used in online animal behavior and veterinary training courses*
- *Enables students to observe, interpret, and respond to behavioral cues*
- *Supports role-based learning and decision-making scenarios*
- *Allows repeated practice without safety or ethical concerns*
- *Can be integrated into assignments, labs, or simulation-based learning*

SYSTEM DESIGN

- *Browser-based XR simulation (no headset required)*
- *Virtual veterinary clinic environment*
- *Perspective switching (human ↔ canine)*
- *Interaction using standard input devices*
- *Optimized for performance across devices*

SYSTEM OVERVIEW

Virtual Veterinary Clinic Environment



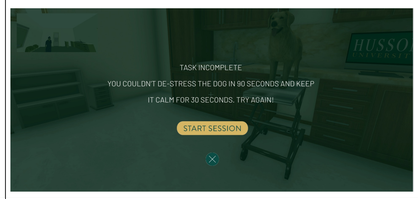
Animal Interaction Scenario with Behavioral Monitoring



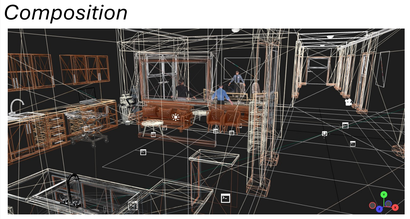
Real-Time Behavioral Indicators (Stress and Odor Levels)



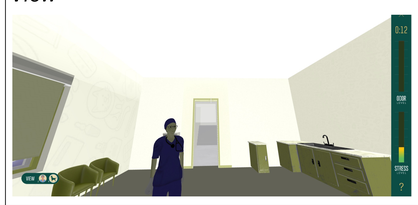
Feedback System Based on User Performance



Underlying System Structure and Scene Composition



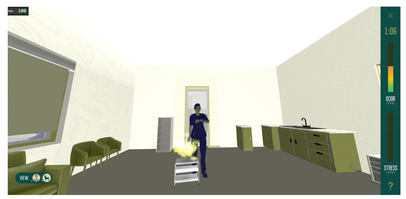
Perspective Switching: Human to Canine View



User Interaction and Control System



Environmental Cues Influencing Animal Behavior



KEY FEATURES

- *Real-time interaction within browser*
- *No installation required*
- *Lightweight and accessible design*
- *Works across multiple devices*
- *Supports live and self-paced learning*

CONCLUSIONS

- *XR can support experiential learning in online settings*
- *Browser-based design improves accessibility*
- *Reduces dependency on physical environments*
- *Applicable across STEM and STEAM fields*
- *Evaluation of learning outcomes planned*
- *Scalable for online workforce training and applied STEM education*

LIMITATIONS

- Simplified behavioral modeling compared to real-world conditions
- Does not replace hands-on interaction with live animals
- No formal user study conducted at this stage
- Performance may vary across devices

REFERENCES

- *Kolb, D. A. (1984). Experiential Learning: Experience as the Source of Learning and Development.*
- *Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education.*

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