COLLEGE OF ENGINEERING

Electrical Engineering and Computer Science

BioMR: BIOMETRICALLY RESPONSIVE VIRTUAL REALITY

BACKGROUND & THEORY

- Human perception is a construct of environmental cues which inform the way we think, feel, and act. Substantial funding has gone towards the research of optimal work environments, or the factors that contribute to creating a safe and calming environment in various scenarios.
- In virtual reality, we can manipulate such factors to a greater extent than is possible in real-world environments. Prior studies have shown that simple alterations to the virtual environment can dramatically affect user experience. For example, a user's estimation of the time spent using VR can be deliberately affected by the movement of the virtual sun.
- Through the BioMR system, we can investigate the effects of various environmental factors by measuring a user's biometric responses within a virtual experience parallel to the current state of their simulated environment.
- We can then respond to stimuli patterns and biometric signal peaks in real-time by changing parameters of the virtual environment identified as affecting aspects of cognition relevant to the virtual experience.
- This creates a system in which user experience can be automatically adjusted in response to individual user bio-feedback.
- Our BioMR demo demonstrates this by adjusting VR environments in response to measurements of GSR, ECG, and pupillary response.

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In virtual and mixed reality, a person is immersed in a simulation.

By changing that simulation, we influence the way they feel and react within a virtual experience.

THE BioMR SYSTEM

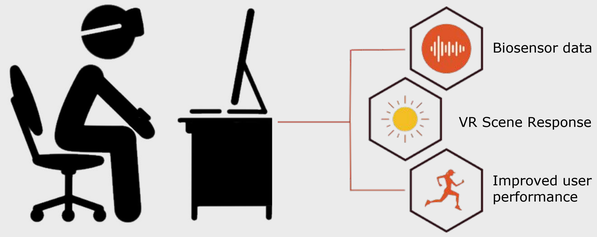

Figure 1: System concept infographic

The BioMR system automates this process of responsive design in real-time by changing virtual environments in reaction to user biometric data, such as heart rate and eye movement.

FEATURES

- BioMR receives physiological data from biometric sensors worn by the user
- VR scenes adapt and respond based on user-defined patterns in collected data
- Developers can use BioMR to create responsive user experiences
- Researchers can use BioMR to analyze user responses to virtual stimuli

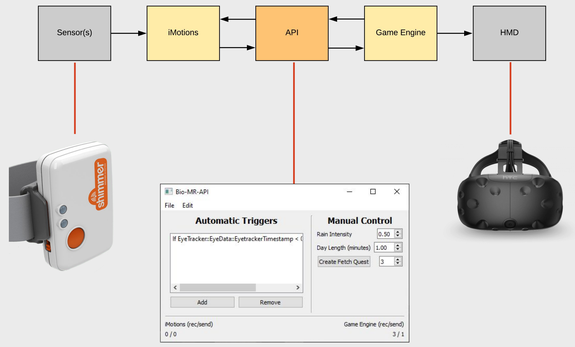

Figure 2: Data Flow of BioMR

Figure 3: Demo scene in the Unity game engine

DEMO

- The BioMR demo consists of two VR scenes, implemented in the Unity and Unreal Engine 4 game engines
- User GSR, ECG, and pupillary responses are measured through physical sensors and iMotions biometrics software
- The BioMR API takes aggregated signal data from iMotions and translates peak signals into appropriate game engine responses
- Examples:
  - Rain intensity increases with heart rate
  - Day length decreases with high skin conductance

OUR TEAM

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Infographic image credit: Canva