

# SenseBeat: Embodied Interaction for Creativity and Learning through Sensor-Based Play

Andreea Iulia Buzenchi  
Transilvania University of Braşov  
Romania  
andreea.buzenchi@student.unitbv.ro

Alexia Mihaela Chirila  
Transilvania University of Braşov  
Romania  
bordeaalexia24@gmail.com

Denisa Cristina Crihana  
Transilvania University of Braşov  
Romania  
denisa.crihana@student.unitbv.ro

Gabriela Maria Marian  
Transilvania University of Braşov  
Romania  
gabriela.marian@student.unitbv.ro

## ABSTRACT

*SenseBeat* is an interactive desktop application designed to enhance creativity, movement, and technological learning through embodied interaction. Developed using Arduino and Unity, the system transforms physical motion into digital feedback, allowing users to engage with computing concepts through real-time body-based input. The application features an educational module that introduces users to sensor-based systems and a game module that encourages fast-paced, expressive interaction. By combining motion tracking, real-time response, and a visual interface, *SenseBeat* bridges entertainment and learning, especially for those with little or no experience in embedded systems. The application aligns with inclusive computing goals by making interaction intuitive and inviting, particularly for women and underrepresented groups in tech.

## KEYWORDS

Arduino, Unity, motion tracking, embodied interaction, HCI, creative computing, inclusive learning, sensor systems

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## 1 INTRODUCTION

Embodied interaction in Human-Computer Interaction (HCI) explores how physical actions can drive digital outcomes, fostering deeper engagement and intuitive control. *SenseBeat* exemplifies this concept by transforming simple body movements into interactive feedback using real-time sensor data. The application enables users to connect with computing concepts not through abstract

code, but through their bodies—making the experience immediate, expressive, and accessible.

## 2 CONTEXT

Traditional introductions to embedded systems and computing often rely on text-heavy tutorials or pre-configured setups that may feel unapproachable to non-technical users. *SenseBeat* addresses this barrier by combining creative play with real-time physical feedback using Arduino sensors and Unity’s visual interface. Inspired by educational frameworks and inclusive computing research [1, 2], the application lowers the entry threshold by focusing on body-based interaction, intuitive visual prompts, and real-time feedback loops.

This aligns with the womENcourage mission to foster diversity in computing by offering experiences that emphasize creativity, inclusivity, and playfulness in technical domains.

## 3 SYSTEM DESCRIPTION

The system is structured into two main modules:

### 3.1 Educational Module

The educational section introduces the hardware and software components in an interactive format. Users learn about:

- **Sensors:** Motion detection via Arduino-connected accelerometers
- **Feedback:** Visual and LED-based feedback
- **Communication:** Serial interface between Arduino and Unity

This module is designed with non-experts in mind, offering animations and explanations accessible even to users with no prior coding or electronics experience.

### 3.2 Game Module

In the game mode, users wear two motion sensors (left/right hands) and have a third sensor placed near their leg. The screen displays an animated avatar providing prompts (e.g., "raise left hand") every few seconds. Users must match the prompt using the correct limb within two seconds.

Game logic includes:

- Point rewards for correct movements
- Time penalties for missed or late actions

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- Visual animations and sound effects for feedback
  - Final score and replay option after each session
- This module emphasizes flow [3], quick decision-making, and intuitive interaction rather than complexity—making it enjoyable for users of all technical backgrounds.

#### 4 CONCLUSION

*SenseBeat* transforms movement into a learning and gaming experience by combining Arduino sensor data with visual storytelling in Unity. It empowers users to see how physical actions produce digital effects in real-time, encouraging exploration of embedded systems and human-computer interaction without needing prior experience.

#### 5 FUTURE PERSPECTIVES

Future enhancements include:

- Support for more complex movement patterns using additional sensors

- Integration with mobile devices via Bluetooth
- Adaptive difficulty based on player performance
- Visual customization (avatars, colors, themes)
- Multiplayer modes for cooperative or competitive play

These improvements aim to deepen the educational and entertainment value while expanding accessibility and creativity.

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