

Executive Summary

This project presents a programmable dance pad controller designed for compatibility with open-source rhythm games such as StepMania and Project OutFox. The system features a four-panel “plus-shaped” layout with a central input, enabling enhanced game play compared to traditional four-panel designs.

The controller integrates pressure-sensitive load sensors, a centralized input processing system, and LED-based visual feedback to provide a responsive and immersive user experience. The goal of this project is to deliver a low-latency, customizable, and durable input device for rhythm gaming applications.

Background

- Rhythm games rely heavily on precise timing and responsive input systems. Traditional dance pads often lack adjustable sensitivity, limiting performance and user experience.
- This project addresses these limitations by introducing:
 - Programmable sensitivity using load sensors
 - A modular layered system architecture
- The broader goal is to improve accessibility and performance for both casual and competitive players.

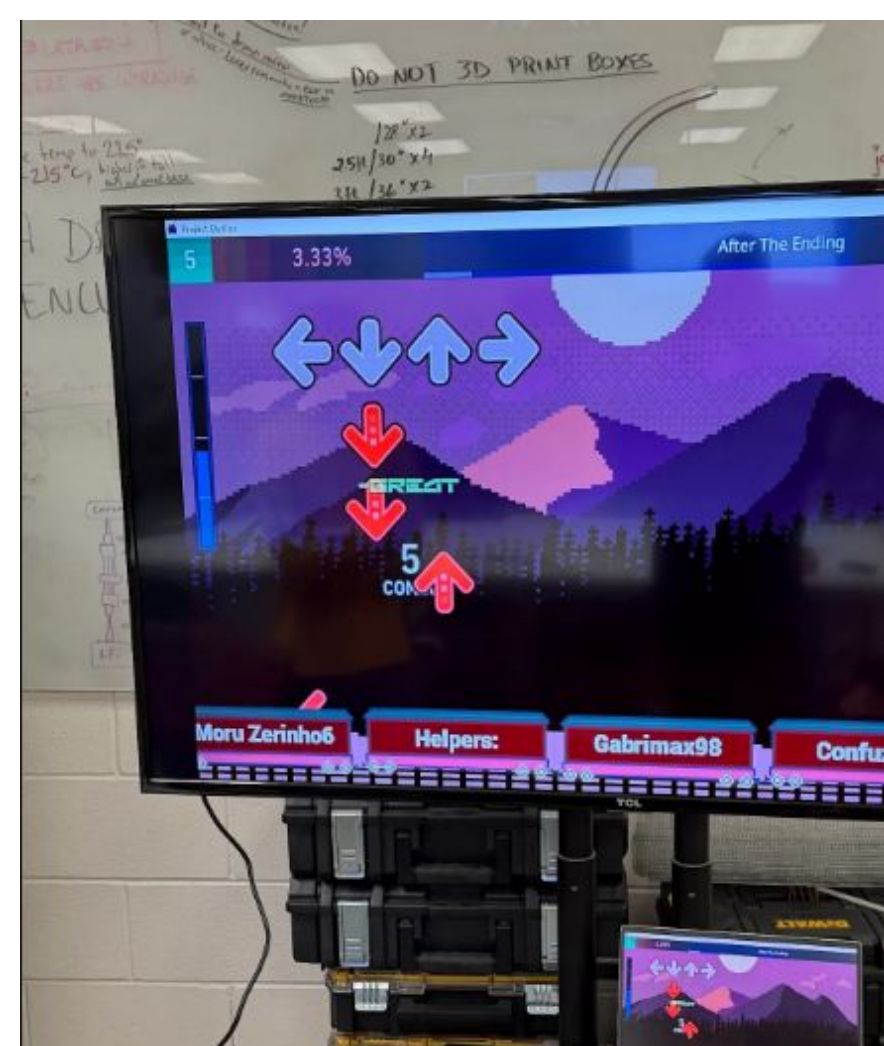


Figure 1. StepMania Game Software

Experimental Setup

The system was implemented using:

- Load cell sensors (0–200 kg range)
- HX711 Load cell amplifier (binary conversion)
- Arduino Uno R3 (input processing)

Testing focused on:

- Input responsiveness
- Signal accuracy
- System latency

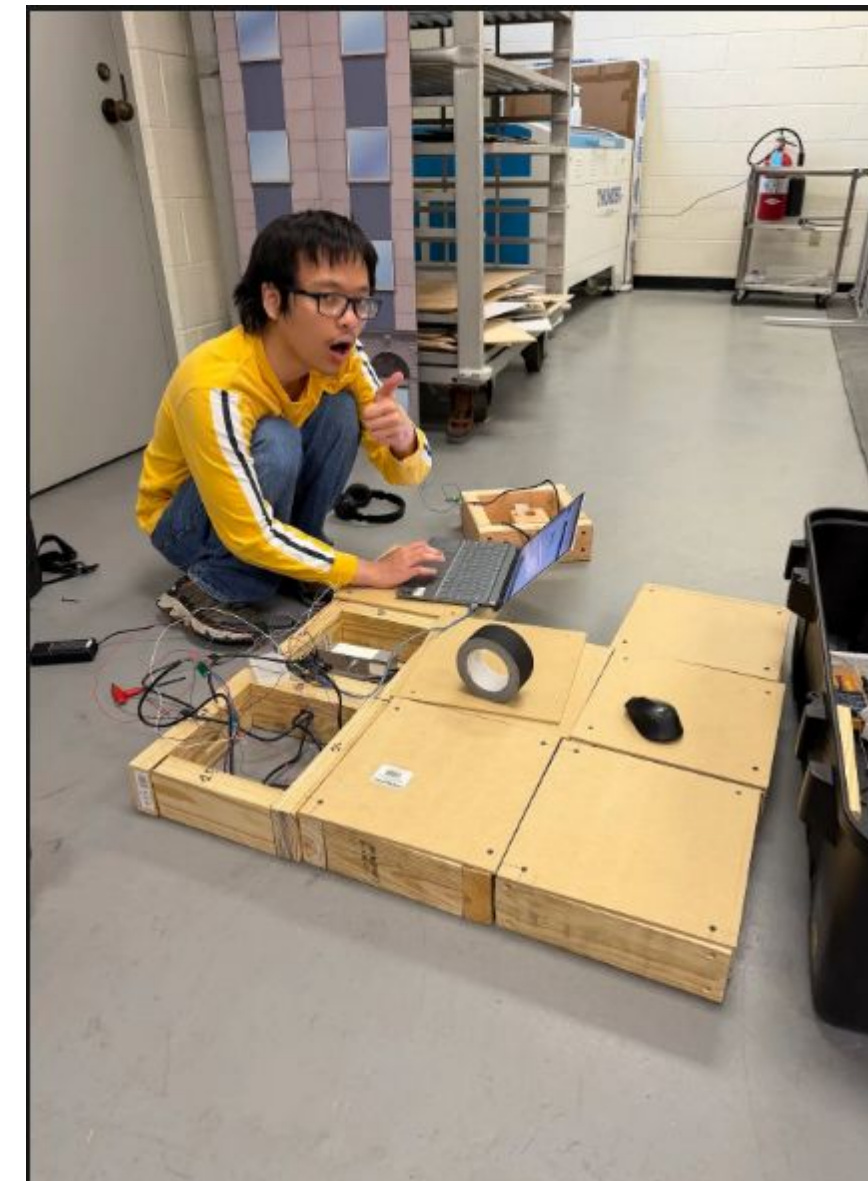


Figure 2. StepMania Game Software

Experimental Results

- The system successfully:
 - Detected user steps
 - Outputted binary signal
- The modular design allowed for:
 - Easy scalability
 - Adjustable sensitivity
 - Reliable communication with host systems



Figure 4. DDR Game Pad

System Design / Architecture

- The system is composed of three primary layers:
 1. Input Panel Layer
 - Detects user input using load sensors
 - Converts pressure into electrical signals
 2. Centralized Input System
 - Processes and validates inputs
 - Applies filtering and sensitivity adjustments
 - Translates inputs into computer-readable signals
 3. LED Control Layer
 - Provides visual feedback
 - Activates LEDs based on user interaction
- The system follows a layered data flow from physical input to digital output, ensuring low latency and reliable performance.

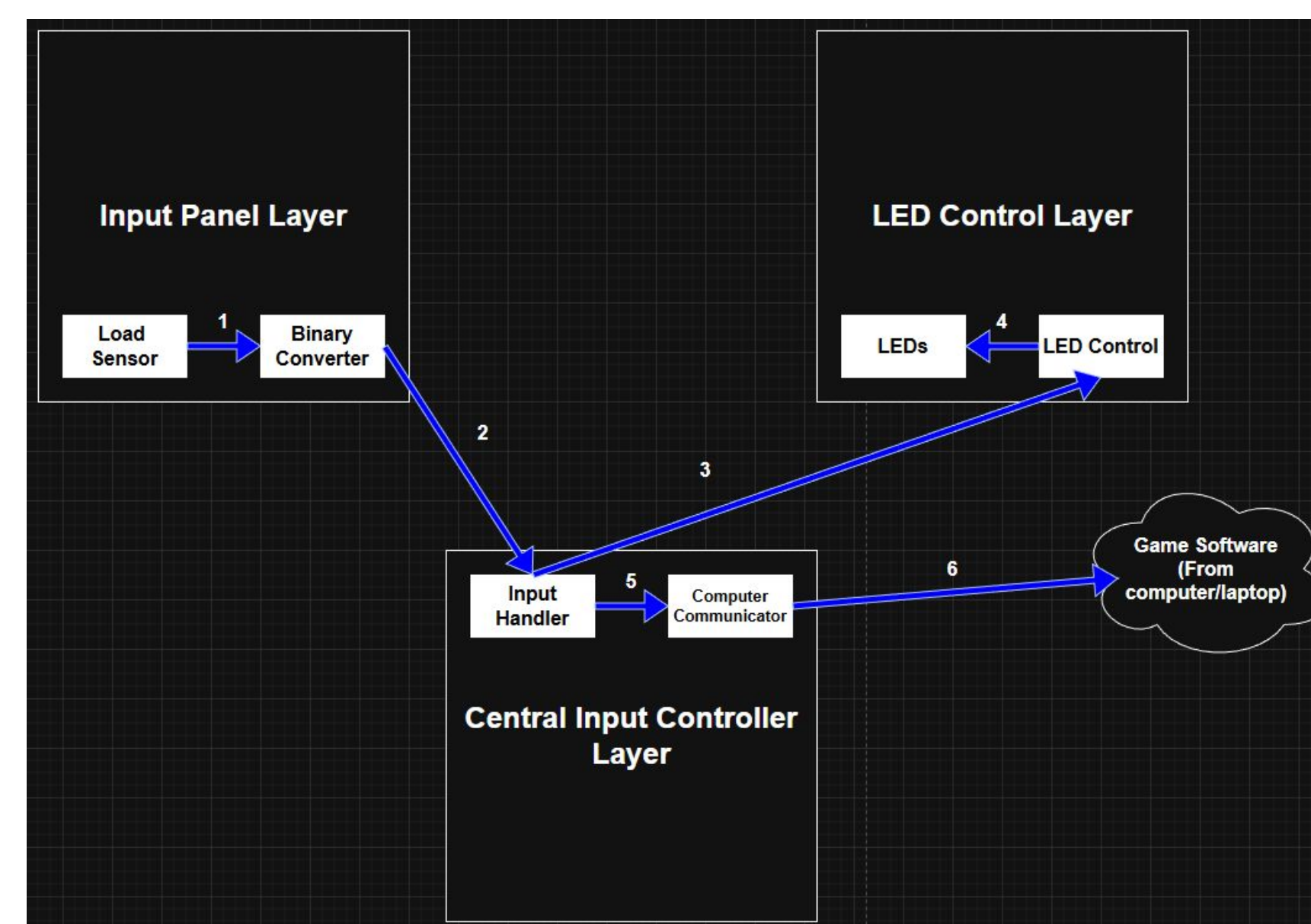


Figure 3. A simple data flow gram

Conclusions

- The system successfully implemented a functional multi-panel dance pad controller capable of interfacing with rhythm games. However, a major limitation was identified in the load cell amplifier, which operated at ~10 Hz instead of the expected 80 Hz, introducing significant input latency.
- Software-based mitigation strategies were explored but achieved limited success, as the bottleneck was hardware-dependent. Additionally, the loss of one load cell reduced the system to four functional inputs.
- This project highlights the importance of hardware limitations in real-time systems.
- Future work: higher-speed amplifiers, reduced latency, and full 5-panel restoration.

References

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