Final Project Proposal Presentations

ESE 5190 Fall 2025

Electrical & Systems Engineering
University of Pennsylvania

Penn Engineering

T28 – Minus.5

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Penn Engineering

Questions!

How many people know what is a ***guitar***?

Can you imagine that
you could play guitar solos and sing along
—without ever learning a single chord?

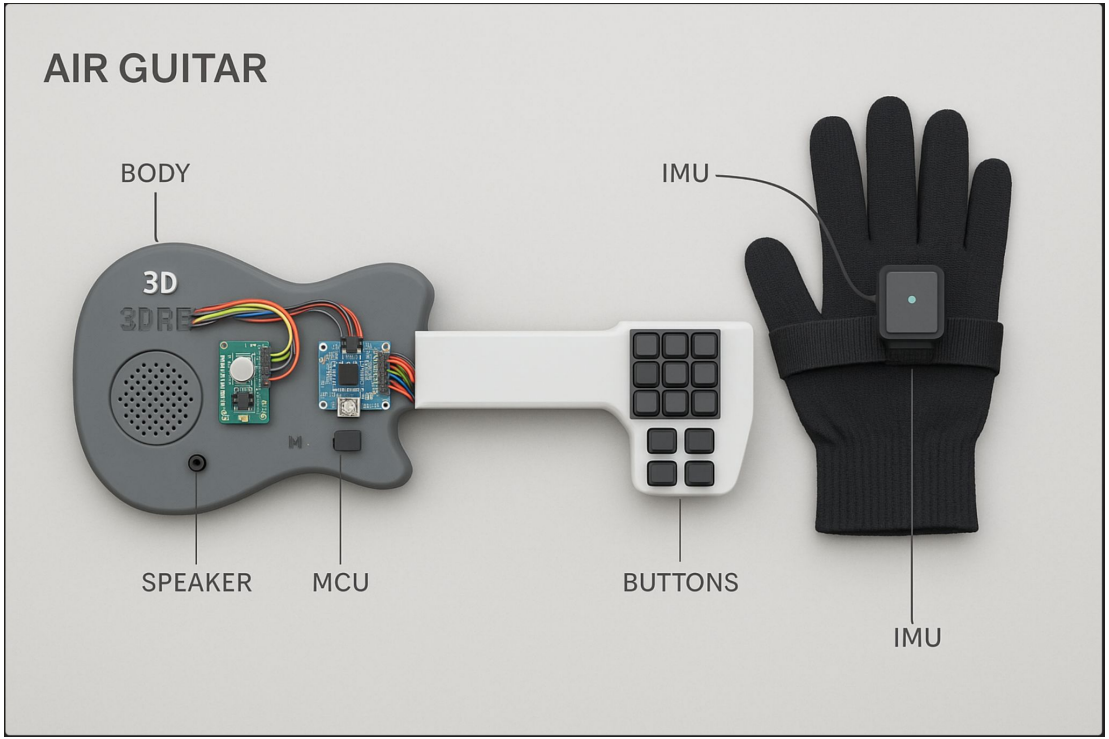
How many of you know how to ***play a guitar***?

Now!

Making the impossible possible!

We shall introduce to you

The AirGuitar



Notice:
AI-generated concept rendering.
Final appearance subject to physical build and implementation.

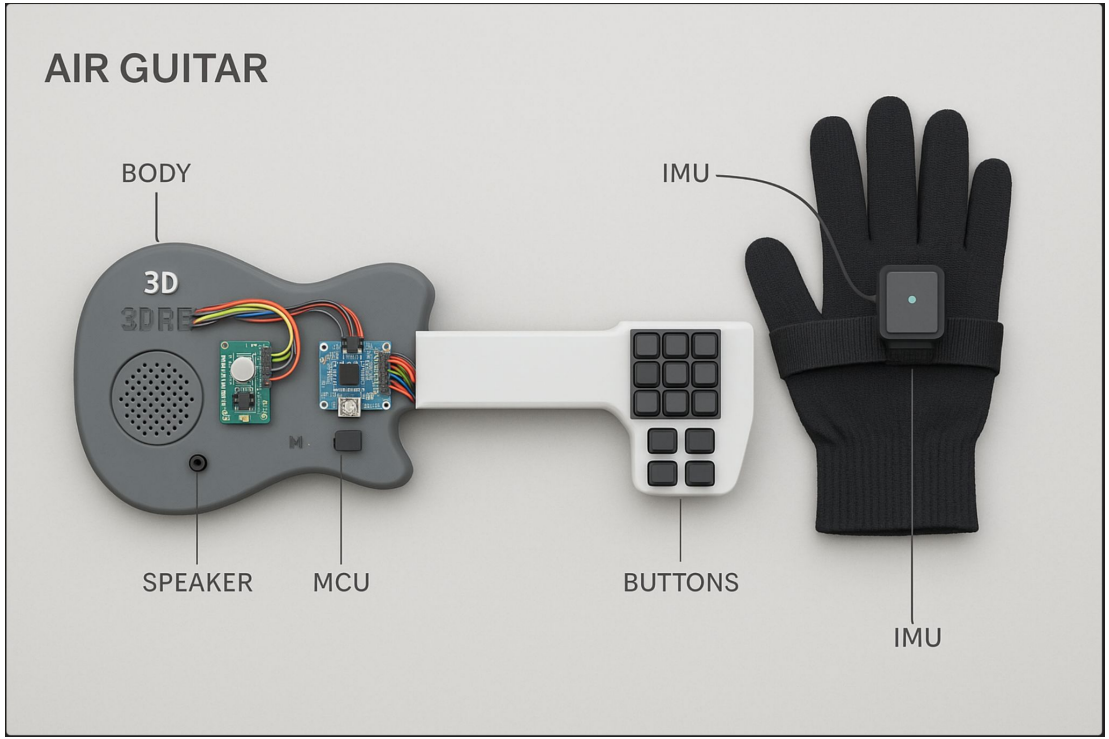
We shall introduce to you

The AirGuitar

Simplifies everything:

Fixed chord mappings

—always makes great sound

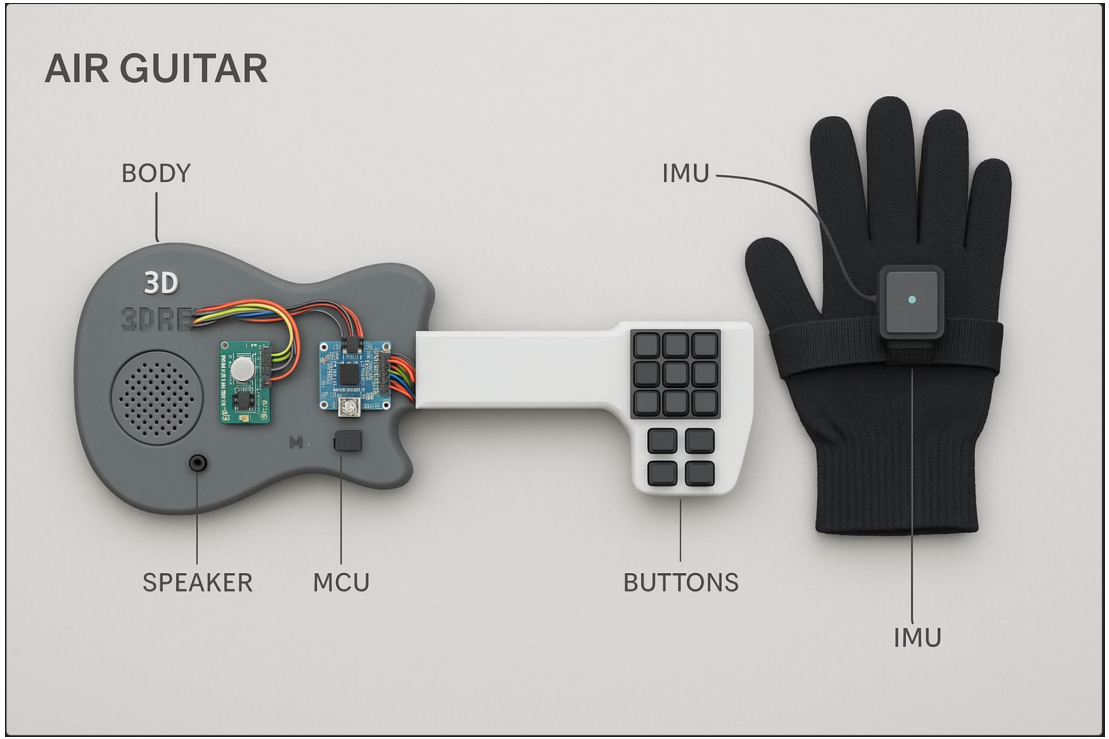


We shall introduce to you

The AirGuitar

Simplifies everything:

IMU-based strumming—natural gestures, no strings required.

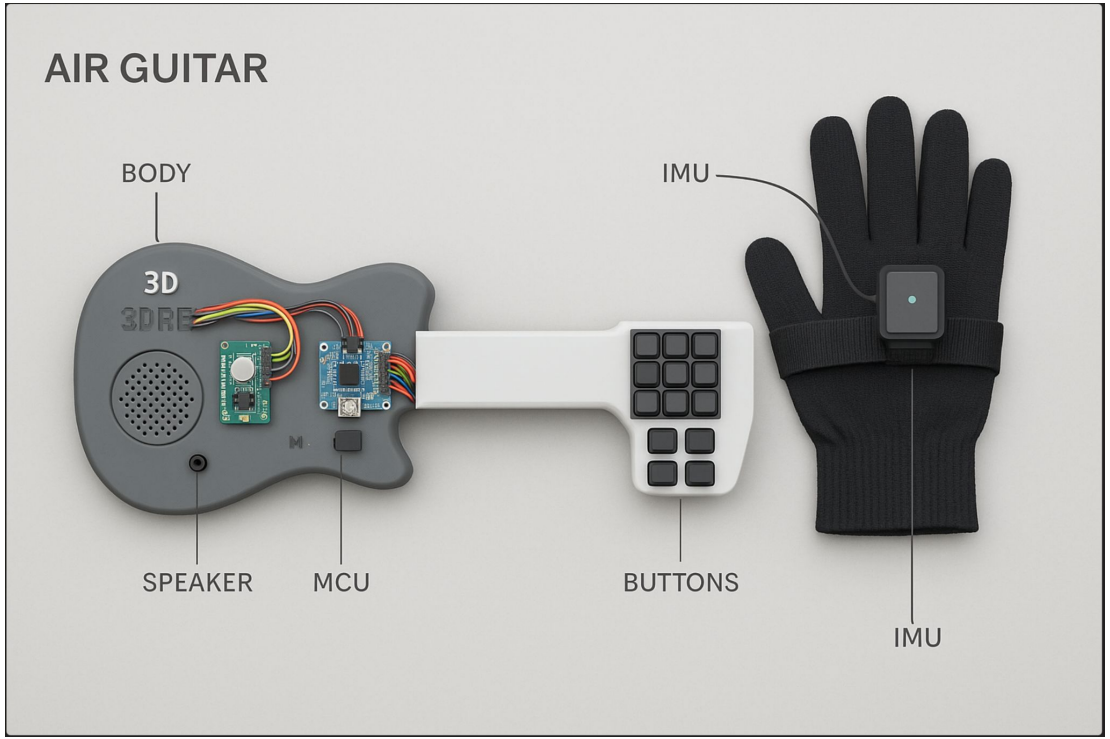


We shall introduce to you

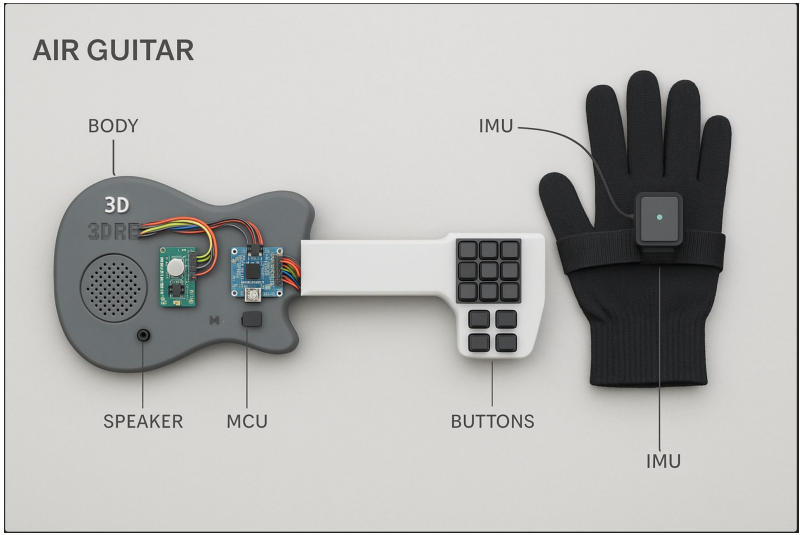
The AirGuitar

Simplifies everything:

"Auto-play" key—press once to auto-cycle chords and sing along.



We shall introduce to you



The AirGuitar

Simple!

Fun!

Accessible!

Music for everyone!

New Era for enjoying music!

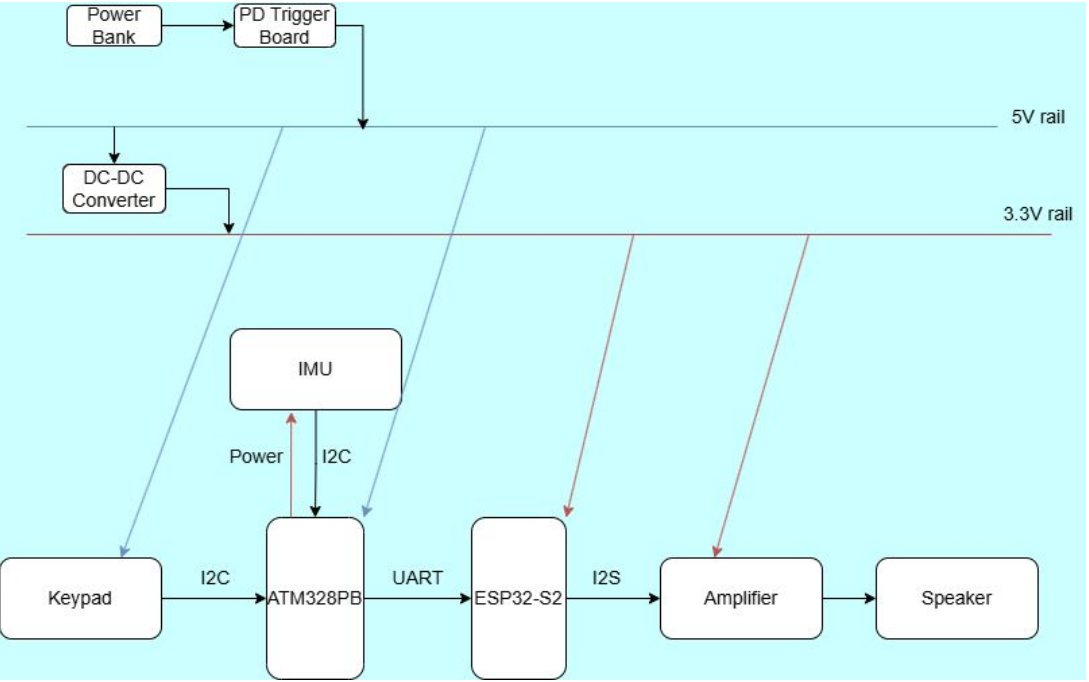
Low-cost on-ramp to music-making; less pressure, more joy.

Useful for music education, therapy, and quick prototyping of song ideas.

Socially sticky: instant accompaniment for singers;
yes, potentially a low-effort way to “impress your crush.

Accessible, Interactive, Creative, and Inspirational
—turn hesitation into participation.

System Block Diagram



Input Side

- Keypad (I²C) → chord selection
- IMU (I²C) → detects strumming gestures
- ATmega328PB → processes both inputs and sends data to ESP32 via UART

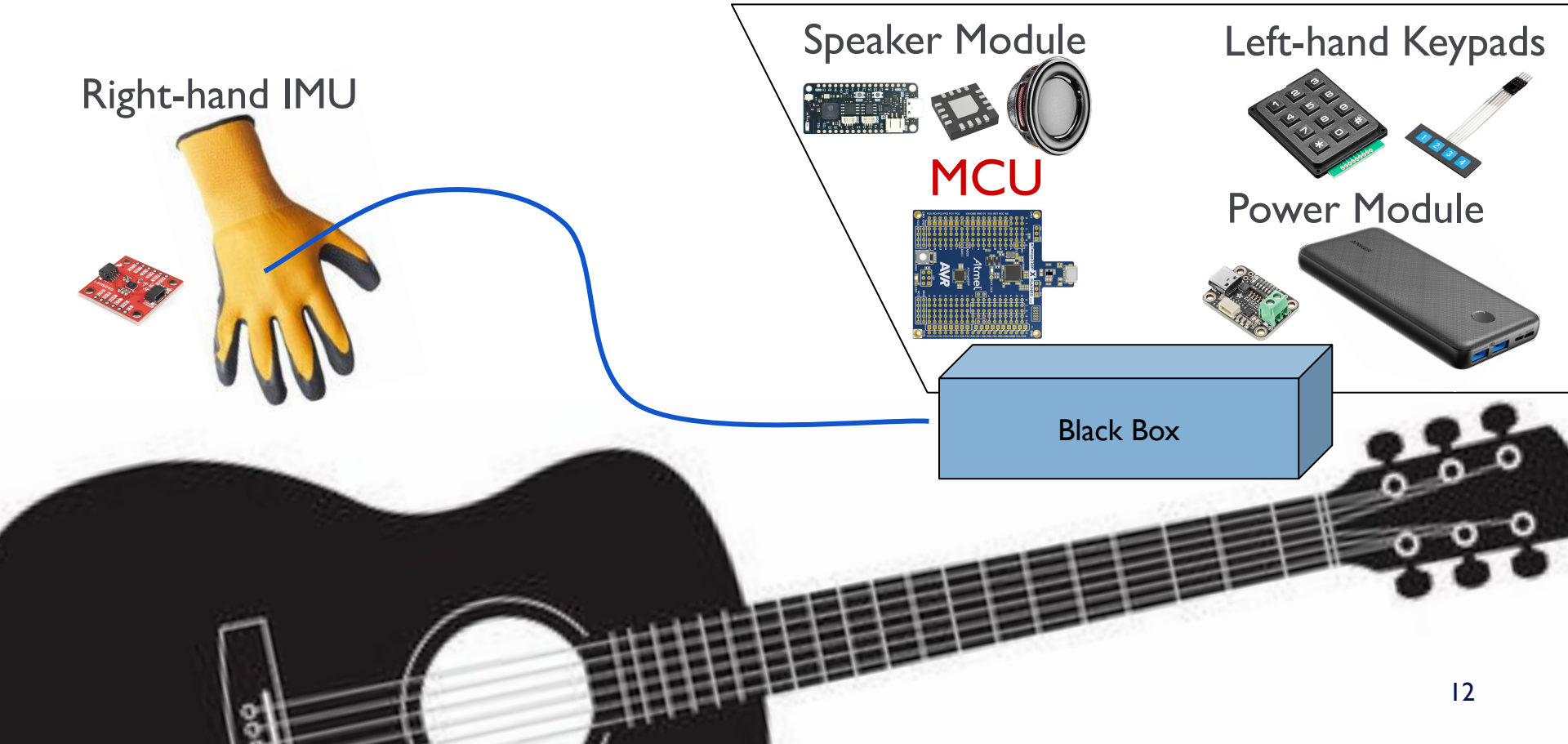
Output Side

- ESP32-S2 → generates corresponding guitar sounds
- I²S → digital audio to amplifier, then speaker

Power

- 5V output from PD trigger board, regulated to 3.3V via Buck-Boost.

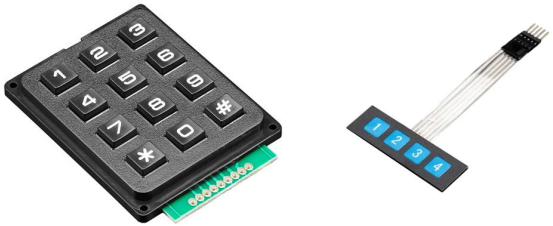
Play a compact, light, portable "Guitar"



Play it without knowing how to play the guitar

Right-hand IMU

Left-hand Keypads



Just wave your hand –

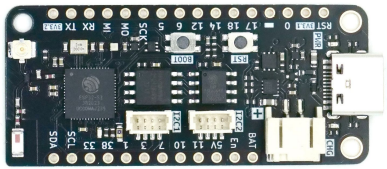
IMU captures 4 strumming gestures (up/down x strong/soft)

Select from 12x2=**24 Chords**!

Optional **Auto** Mode

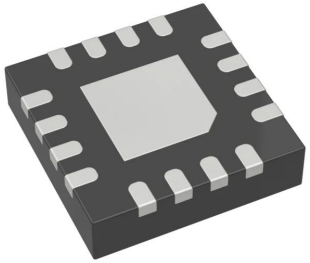
Inspire your friends with high-quality music!

Speaker Module



ESP32

Low latency



Amplifier + Driver

Sufficient Volume

Speaker

Full-frequency

Amy: A Music Synthesizer Library

Emulate sound of a real guitar

Simple.
Effective.
Transformative.

That's a wrap!

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