

# SampleRate

SUMMER KRINSKY, CCRMA, Department of Music, Stanford University, USA

## 1 Program Notes

SampleRate is an interactive sound installation in which light functions as a shared, embodied interface for collective music-making. Specially designed 3D-printed flashlights are instruments of musical discovery; their strobing beams are clock-synchronized to different subdivisions of a shared tempo. As participants sweep their flashing lights through a darkened space, they reveal a suspended net of distributed photoresistor sensors. When a beam strikes a sensor point, it triggers a one-shot audio sample; repeated hits retrigger the sample into rhythmic patterns. Sample assignments morph slowly across longer phrases, producing continuously shifting textures. In this system, illumination becomes a compositional action: uncovering each zone of space audibly reveals voices within an unfolding piece. The resulting form is contingent on collective interaction—each iteration is re-authored by the crowd, and no two sound the same. Overlapping beams cast polyrhythmic shadows across the net—an emergent visual counterpoint that makes rhythmic structure legible in the room and invites coordination between participants.

The work is shaped by the author's Detroit roots, the birthplace of techno. It draws inspiration from dance-floor practices in which crowd motion and mood reflect the music and—through an attentive DJ—shape its trajectory. Prior work has similarly explored audience participation in club contexts as an explicit design material for musical form and agency. [3] SampleRate makes this relationship explicit by treating the audience as a distributed controller with immediate, direct agency: each flash on a sensor corresponds to a discrete musical action, while group behavior determines density, form, and feel. Participants decide which voices enter and when, generating rhythmic structures that include Euclidean patterns, hemiolas, and longer-cycle misalignments that rotate against the barline. A shared pulse preserves groove and collective intelligibility while allowing surprising metric turns and crowd-driven shifts in musical direction.

## 2 Project Description

SampleRate is designed for audience-scale participation beneath a ceiling-suspended net containing photoresistor sensor nodes. The work can be installed in two configurations depending on the available space:

- **Small configuration:** 5 ft × 10 ft net with **12** sensor nodes
- **Large configuration:** 10 ft × 20 ft net with **24** sensor nodes

Participants interact by sweeping tempo-synchronized flashlights across the net to “discover” sensor points and activate sonic material. Each flashlight strobes at a distinct subdivision pattern (relative to a shared tempo), enabling polyrhythmic layering while maintaining a common pulse across devices. When a beam hits a sensor node, the system triggers the sensor's assigned one-shot sample. Because

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the flashlights strobe continuously, repeated hits on a sensor generate rhythmic patterns; across longer phrases, sample assignments evolve to create a changing but coherent musical surface. In addition to discrete triggering, continuous qualities of light act as expressive control signals. Beam intensity and diffusion are mapped to parameters such as spectral filtering, reverberant depth, and delay, allowing participants to articulate timbre and depth through gesture rather than screen-based interaction. Since light is visible across the room, actions are socially readable: participants can anticipate cause-and-effect, coordinate with others, and negotiate density and structure in real time.

### 3 Performance Notes

#### Installation format

SampleRate is presented as a suspended, overhead sensor net that participants activate with tempo-synchronized handheld flashlights. The net and sensor modules are very lightweight, and are intended to be hung from existing overhead points (grid/truss/hooks) provided by the venue.

#### Technical system overview

- Flashlights: 8 handheld units (each contains an ESP32-based wireless node)
- Central system: 1 computer running Max/MSP + 1 ESP32 connected to a hub unit
- Sensor network: 12–24 photoresistor sensor modules mounted in the net
- Connectivity: sensor signals run from the net to the hub via ¼" TRS cable connections
- Audio output: stereo output from the computer/hub to the venue sound system



Fig. 1. Two flashlights being used to make music by an installation participant.

#### Venue requirements

1. Rigging / suspension

- The net must be suspended from the ceiling (ceiling grid points, hooks, truss, or other safe overhead suspension options). The net and sensor array are lightweight (low static load, on the order of a few pounds total), so typical overhead mounting hardware is sufficient.
  - The net should hang above head height with safe clearance for participants moving beneath. A typical gallery/theatre ceiling height is sufficient.
2. Lighting
    - Very low ambient light is strongly preferred so beam aiming and sensor activation remain clear and legible. Full blackout is not strictly required, but controllable/dimmable lighting is ideal.
  3. Stands and storage
    - Mic stands (or comparable stands): 4-8 stands for flashlights when not in use (prevents drops, supports quick reset, supports accessibility).
  4. Audio
    - Stereo PA (2 speakers) with a basic mixer/DI if needed for laptop audio.
    - Additional reinforcement/subwoofer is optional depending on room size and ambient noise.
  5. Power
    - At least 1–2 standard AC outlets at the control/computer location (computer + hub + any accessory power supplies).

#### Artist-provided equipment

- Net
- 12–24 sensor nodes (custom printed PCB boards with photo resistors, LEDs for sensor location clues, custom 3D printed cases) mounted in the net
- 4-8 custom flashlights (with embedded ESP32 nodes, custom printed PCB boards, 3D printed cases)
- Hub unit (ESP32 + sensor interface and ¼" inputs on custom PCB board, 3D printed cases)
- ESP32 and control computer running Max/MSP
- Necessary cabling to connect net → hub and standard audio output from the computer

#### Setup / strike (typical)

- Setup: suspend net, route cables from net to hub, place stands, connect audio, calibrate sensors for the room's ambient conditions
- Strike: remove net + stands, coil cables, pack hub/control system (Recommended: ladder access and 1 assistant for efficient hanging and teardown.)

#### 4 Media Link(s)

- Video (full installation): [https://www.youtube.com/watch?v=lrnAKADG\\_NU](https://www.youtube.com/watch?v=lrnAKADG_NU)
- Video (single sensor vocab): <https://www.youtube.com/watch?v=Tok7yVI3A2M>



Fig. 2. The flashlights being used to make music by a group of installation participants.



Fig. 3. 3D renders of the flashlight body design.

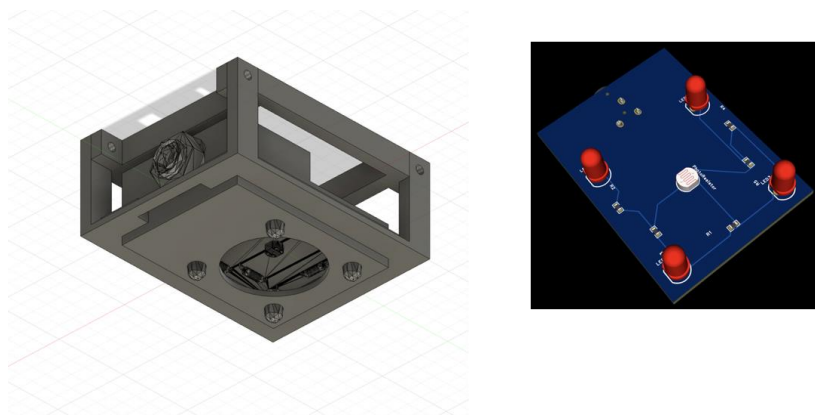


Fig. 4. 3D renders of the photoresistor sensor design.

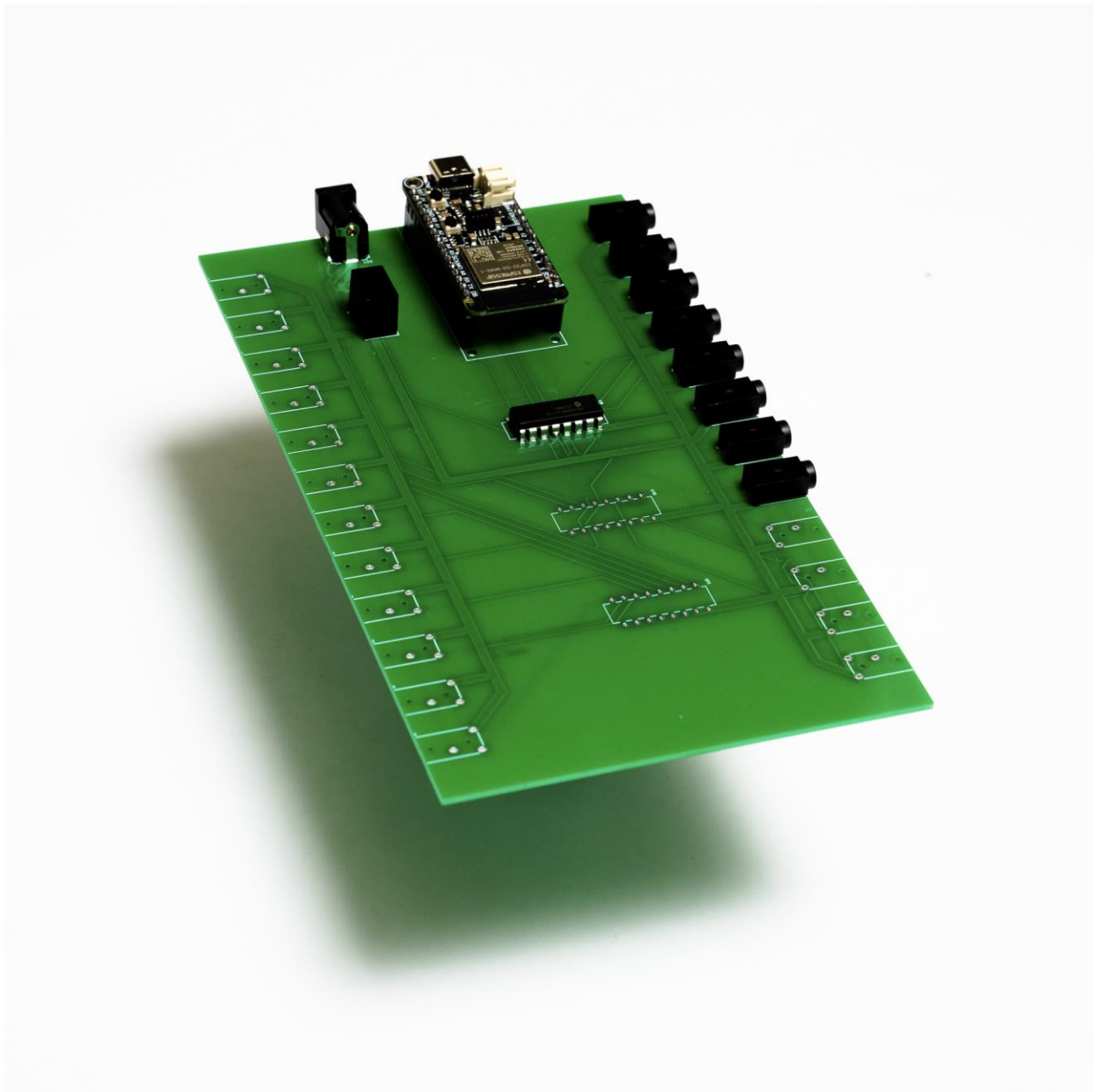


Fig. 5. Partly assembled PCB board for sensor hub.

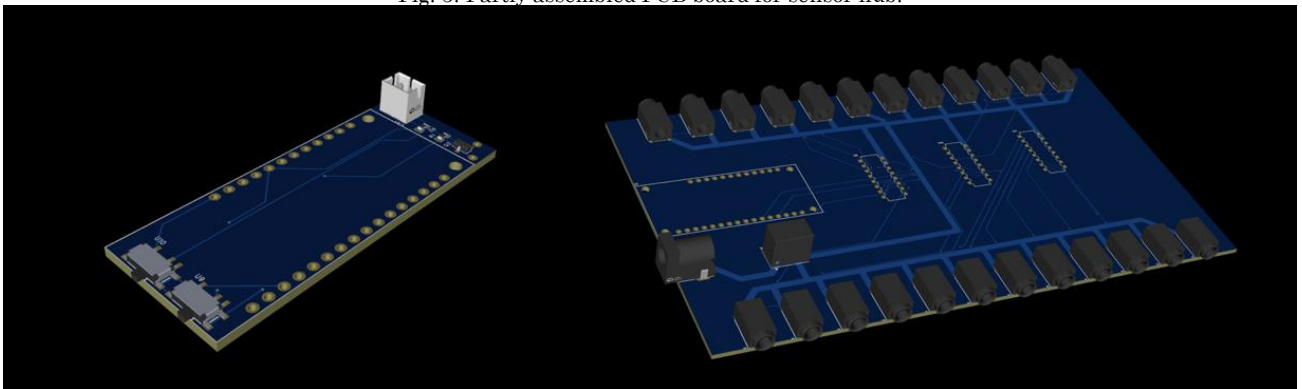


Fig. 6. 3D renders of the flashlight PCB board and sensor hub PCB board.



Fig. 6. Flashlights with their networked microcontrollers.



Fig. 7. Assembled sensor board.

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## Ethical Standards

SampleRate involves voluntary public participation in a gallery/performance context. No personally identifying data is required for interaction. The installation is designed with participant safety in mind (clear walking area beneath the net, conservative lighting intensity, stable suspension, and no exposed electrical hazards). If documentation is recorded (video/photo), appropriate notice/ signage will be provided, and dissemination will follow venue and conference guidelines.

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