

Lab 1: Sapphire Sounds

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Version 5

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1 Introduction

Noise disputes in shared living environments are often difficult to resolve due to reliance on subjective complaints. This can result in false accusations, unresolved tensions, and overall tenant dissatisfaction. Currently, there is no widely adopted method for monitoring and verifying noise disturbances that is both objective and privacy conscious.

Sapphire Sounds addresses this problem through a mobile and web application that works with a non-invasive noise sensor. The sensor measures sound levels without recording audio. When high noise levels persist, the system generates time-stamped reports to help property managers resolve disputes fairly. Tenants can also monitor their own noise history, receive real-time alerts, and earn rewards for maintaining a quiet environment. By providing clear and unbiased data, Sapphire Sounds supports more peaceful and cooperative shared living spaces.

2 Sapphire Sounds Product Description

Sapphire Sounds is a mobile and web application that connects to a small noise sensor. The sensor tracks how loud sounds are, but does not record any audio. If noise levels remain too high for too long, Sapphire Sounds generates a report with the time and noise level. These reports help property managers resolve complaints fairly. Tenants can view their own noise history, receive alerts when they are too loud, and earn rewards for maintaining quiet. Sapphire Sounds promotes peaceful shared living by providing clear, unbiased data instead of relying on personal opinions.

2.1 Key Product Features and Capabilities

Sapphire Sounds is a mobile and web application that interfaces with a compact noise-detection sensor. The system measures sound intensity in decibels (dB) without recording actual audio, preserving privacy while objectively logging noise events. When sustained high noise levels are detected, it generates time-stamped reports to facilitate transparent resolution of complaints.

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2.1.1 Privacy-first monitoring

This system only collects sound intensity without collecting sound content, ensuring tenant privacy while still tracking disturbances

2.1.2 Data driven dispute resolution

It replaces subjective complaints with clear, time-stamped decibel logs, giving property managers and tenants objective evidence for noise disputes

2.1.3 Positive reinforcement

Rewards are offered to tenants who maintain acceptable noise levels, promoting respectful community behavior

2.1.4 Smart Alerts

The system sends real-time alerts to tenants and escalates to landlords/managers only when violations persist, allowing early self-correction

2.2 Major Components (Hardware/Software)

The system will be using Raspberry Pi Zero 2 W, Infineon CYW43439, and the I2C Decibel Sound Level Meter for the hardware. We will utilize React.js Web/Mobile UI hosted on Firebase, Node.js, PostgreSQL, Github, and Docker & Docker Composed for our software.

2.2.1 Hardware:

Raspberry Pi Zero 2 W acts as the controller that collects data from the noise sensor and transmits it over WiFi. Infineon CYW43439 is an imbedded WiFi chip that enables wireless connectivity for the Raspberry Pi. I2C Decibel Sound Level Meter will measure real-time noise levels in decibels and will connect to the Raspberry Pi via I2C protocol.

The decibel meter connects via I2C to the Raspberry Pi, the Raspberry Pi continuously samples sound levels and timestamps them, the data is securely transferred via WiFi.

2.2.2 Software

React.js Web/Mobile UI hosted on Firebase will be used by tenants and property managers to view noise logs, alerts, and reports. For the backend, Node.js backend hosted on Render.com will handle sensor data

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ingestion, noise analysis, user authentication, and alert logic. For the database, PostgreSQL database will store timestamped decibel logs, user data, noise patterns, and reward tracking. GitHub will be used for source code management and continuous integration

3 Identification of Case Study

Sapphire Sound's primary users will be both tenants and property managers/landlords. The tenants will be able to monitor their own noise habits, avoid disputes, and potentially earn rewards for staying compliant.

The property managers and landlords will be able to fairly investigate complaints, monitor chronic issues, and maintain peace without needing to always be on-site to verify noise levels. This is important as:

- Noise complaints are among the top grievances in shared and multi-unit housing
- Subjective claims often lead to disputes, retaliation, or unfair blame
- Property managers need tools that are fair, consistent, and privacy-compliant

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4 Glossary

- dB (Decibel): A unit to measure the intensity of sounds.
- Noise Event: An occurrence when decibel thresholds are reached for a specific duration.
Used for reporting.
- Noise Sensor: A physical device that monitors sound levels without recording audio.
- Report: A structured report generated by the system, detailing the noise event.
- Threshold: A predefined decibel level, which if exceeded, will trigger a noise event
- Tenant: A resident or occupant of a shared or multi-unit housing space using the system to manage and monitor noise activity.

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5 References

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