Sapphire Sounds

Sapphire Group

Feasibility Presentation

14JUL2025

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PROBLEM	Noise complaints are a common issue in shared buildings. These complaints can often lead to disputes, unfair accusations, and unresolved tension between tenants.
SOLUTION	A software-enabled noise detector that will be paired with a mobile or web app to monitor decibel levels, without recording audio. When noise levels are exceeded for an extended period the system will log the event and generate a report for property managers.
KEY FEATURES	Decibel Tracking Real time alerts Noise history dashboard Auto generated incident reports
BENEFITS	Tenants enjoy peace and quiet, protection from false complaints and property managers receive unbiased data to resolve disputes.
OUTCOME	A more peaceful, quiet, and respectful living environment, driven by transparent data and ethical technology.

Problem Statement

In shared living environments, current noise complaint processes rely heavily on subjective reports, leading to unresolved disputes, false accusations, and tenant dissatisfaction. There is no efficient, unbiased, or privacy-conscious method for tracking and verifying noise disturbances over time.

Problem Characteristics

High prevalence of renters

- About **36 %** of U.S. households are renter-occupied, highlighting the widespread relevance of noise disputes in shared living environments (Parker et al.).

Frequent noise complaints

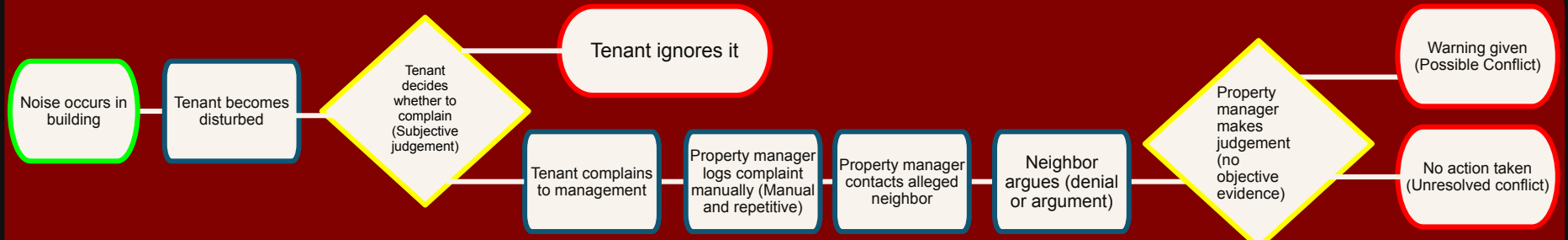
- Nearly **40 %** of people have lodged noise complaints, yet only **20 %** feel their issues were resolved satisfactorily (Bronzaft and Nadler).

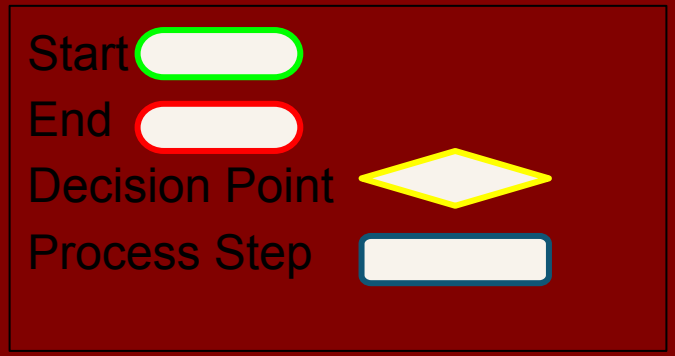
Subjective and unsubstantiated claims

- With 80 % of complainants not having their noise issues addressed—even after formal complaints—there is a clear need for objective evidence (Bronzaft and Nadler).

Inefficiencies in landlord/tenant resolution

- Without reliable documentation, property managers struggle to handle noise reports fairly, leading to tenant frustration and strained relationships.

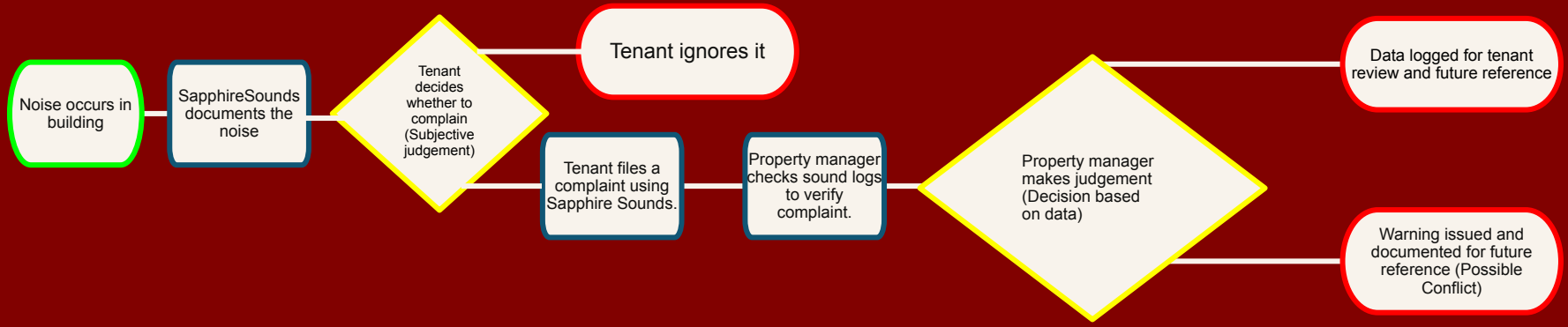


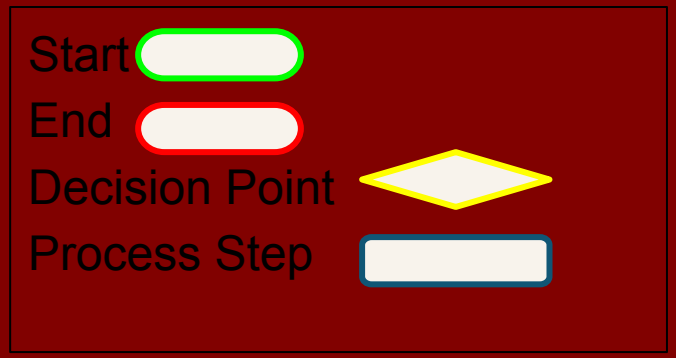


Current Process Flow

Solution Statement

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’re 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.





Solution Process Flow

What it will do

Objectively monitor noise levels

- Use sensors to to detect and log persistent noise violations.
- Capture sound intensity in decibels without recording audio directly, respecting the privacy of tenants.

Provide time-stamped noise report

- Generate logs that show when noise events occur, how long they last, and how loud they are.
- Identify patterns of noise violations.

Support conflict resolution

- Share noise data with affected parties (roommates, tenants, landlords, or property managers) to support fair, evidence-based discussions.
- Use objective data to de-escalate disputes by replacing subjective claims with measurable evidence.

Promote healthier shared living arrangements

- Help maintain a peaceful, respectful environment by discouraging chronic noise violations.

What it will not do

Focus on Isolated, One-Time Noise Events

- Isolated incidents typically do not indicate disruptive behavior. This may lead to unnecessary reports.

Interpret Meaning or Intent Behind Noise

- The system will not analyze the type or intent of sounds, such as distinguishing between arguments, music, or social gatherings. This would require capturing audio, which raises privacy concerns and contradicts Sapphire Sound Monitor’s privacy-first design.
- The system is focused solely on measuring decibel levels. It will not distinguish between different noise sources such as pets, appliances, or people.

Real-Time Noise Enforcement

- Handling the noise conflict will ultimately be left up to property management. Sapphire Sound Monitor is designed to provide objective evidence to support fair decision-making.

Tenants Earn Rewards

Sapphire Sounds encourages tenants to maintain low noise levels by offering incentives such as discounts, recognition badges, or community perks.

Log Access Feature

Tenants will have access to a dashboard where they can view:
- Historical noise events
- Time-stamped decibel logs
- Their compliance record over time

This transparency helps tenants self-regulate and resolve complaints proactively.

Competition Matrix

	Sapphire Sounds	MINUT	RentEye	Traditional Complaint
Privacy (no audio recordings)	✅	✅	✅	✅
Notifications to owner		✅	✅	
Notifications to tenants	✅	✅	✅	
Historical Data	✅	✅	✅	✅
Tamper Detection			✅	
Remote Monitoring	✅	✅	✅	
Tenants Initiate Complaints through the app	✅			
Focused on Preventing/Resolving Noise Complaints	✅			
Tenants Earn Rewards	✅			

Minut. Minut.com. https://www.minut.com
RentEye. RentEye.com. https://www.renteye.com

Development Tools

- **IDE** - VSCode
- **Version Control** - Git with GitHub
- **CI/CD** - GitHub Actions & Workflows
- **Backend Language** - JavaScript (Node.js)
- **Frontend Languages** - JavaScript (React.js), HTML, CSS
- **Database Management System -** PostgreSQL
- **Testing Framework** - Jest
- **Documentation Tool** - JSDoc

Major Functional Components

Software Components

- **Firebase** - For hosting our React.JS frontend.
- **Render.com** - For hosting our Node.JS backend.
- **Clever Cloud** - For hosting our PostgreSQL databases.
- **GitHub** - Beyond repository management, also an origin to deploy to a hosting service.
- **Docker & Docker Compose** - For localized hosting during development.

Sensor Components

- **Raspberry Pi Zero 2 W** - Controller to process sensor readings and send them to the application server.
- **I2C Decibel Sound Level Meter Module** - This sensor will connect to the Raspberry Pi via the I2C Bus (created by PCB Artist).
- **Infineon CYW43439** - WiFi connectivity module built into the Raspberry Pi Zero 2 W.

Off The Shelf Software

- **Node.JS** - Backend
- **React.JS** - Frontend
- **PostgreSQL** - RDBMS

Off The Shelf Hardware

- **Raspberry Pi Zero 2 W** - Sensor Controller
- **I2C Decibel Sound Level Meter Module** - Acoustic Sensor
- **Infineon CYW43439** - Connectivity Module

What We Will Build

- Data Analysis Engine
- Alert Engine
- Decibel Monitoring

Major Functional Components Diagram

What we will build

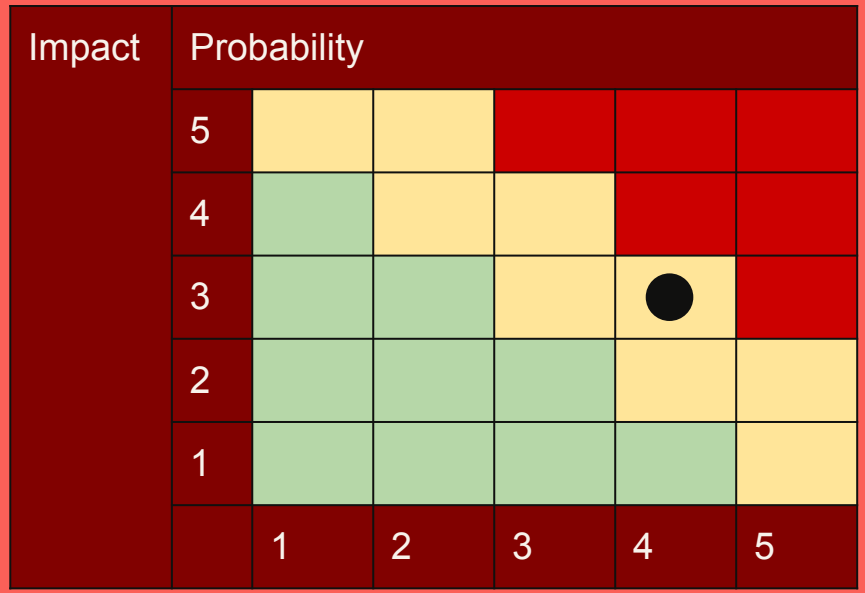
- Data Analysis Engine
  - Anomaly detection
  - Noise profiling by time of day or day of week
  - Noise comparisons across different time ranges
- Alert Engine
  - Real-time alerts to tenants, landlords, or property managers
  - Configurable escalation logic
  - Summarized reports and dashboards
- Decibel Monitoring Logic
  - Real-time decibel level collection and timestamping
  - Short and long-term noise averaging
  - Identification of noise spikes or sustained high volumes that exceed predefined thresholds

Risks

- Customer & End User
- Technical
- Security
- Legal

Customers & End User Risk

Moderate Risk 🚩



Risk: Hesitation to use the Sapphire Sound app or sensor device

Description: Tenants may feel the system is unfair or intrusive, or they may distrust Sapphire Sound altogether, which could result in low adoption and limited participation.

Probability: 4 (quite likely, due to privacy concerns and low initial trust)

Impact: 3 (may prevent fair and consistent noise enforcement across the community)

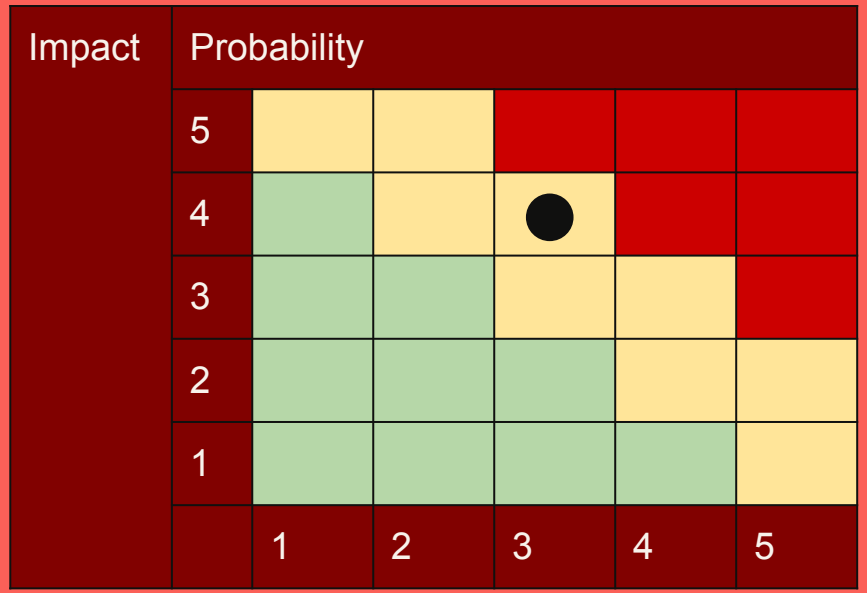
Mitigation:

- Clearly communicate privacy safeguards (no audio recording, only decibel levels)
- Add tenant-friendly features like real-time alerts and a rewards
- Engage community leaders or property managers to champion the system.

Expected Improvement: Probability decreases to 2; impact decreases to 2.

Technical Risk

Moderate Risk 🚩



Risk: Sensor device inaccuracies or failures (false positives/negatives)

Description: Noise sensors may malfunction or misinterpret sounds, leading to incorrect reports or missed noise events. This could undermine trust in the system.

Probability: 3 (moderate, depending on device quality and environment)

Impact: 4 (false reports could cause unfair complaints, missed events reduce system credibility)

Mitigation:

- Use high-quality calibrated sensors with reliable threshold algorithms to effectively disregard irrelevant sounds.
- Include a manual review or appeal process to dispute or clarify flagged noise events
- Consider adaptive tuning for different environments

Expected Improvement: Probability decreases to 1; impact decreases to 2.

Security Risk

High Impact Risk 🚩

Impact	Probability				
5					●
4					
3					
2					
1					
	1	2	3	4	5

Risk: Data breach and unauthorized access

Description: The account connected to the noise sensor could potentially have the user's private information compromised, such as their email, name, and password.

Probability: 5 (High, if the proper security measures are not taken beforehand).

Impact: 5 (Leaked data can lead to identity theft, bank accounts being targeted, personalized targeted scams, and loss of public trust).

Mitigation:

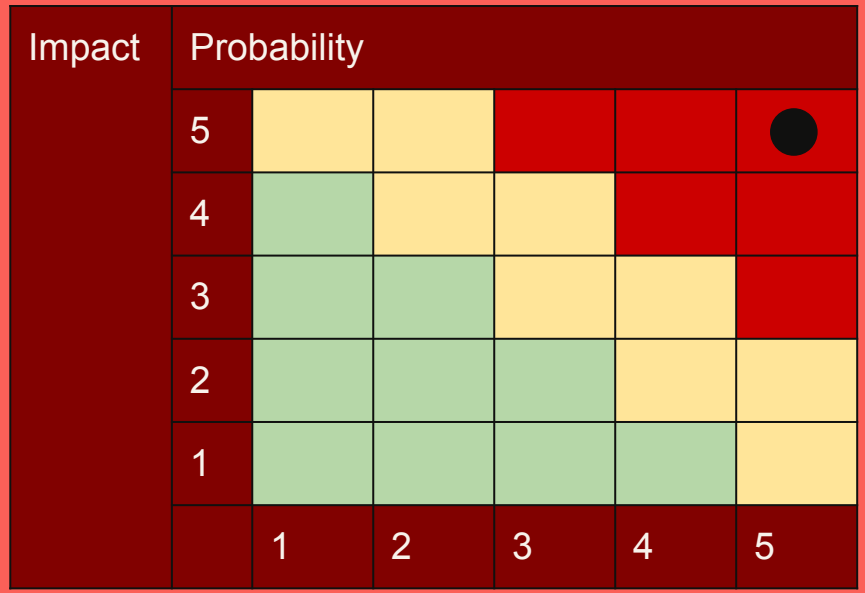
- Device encryption
- Strong Passwords
- 2 Factor Authentication
- Software Updates

Expected Improvement: Probability decreased to 1, but due to the severity of the impact, it will remain at a high level.

Legal Risk

High Impact Risk 🚩

Low Medium High



Risk: Privacy violations and data protection laws

Description: The sound device's acoustic sensor can possibly record private conversations and risk breaking data protection laws. If accounts or devices are compromised then the creators of the device can face severe legal consequences.

Probability: 5 (if proper security precautions and consent agreements are not met.)

Impact: 5 (Legal fines and possible incarceration, loss of public trust, lawsuits, devices being banned / recalled)

Mitigation:

- Get user consent through a legally binding contract and disclose the devices usage and functions to all users.
- Make sure any built-in microphones can **only** record decibel levels.
- Have records of compliance for data protection laws.

Expected Improvement: Probability decreased to 1 and impact decreased to 3 (medium).

Risk Conclusion

Most critical risk: Legal (Privacy violations)

- Mitigations in place reduce technical, customer, and security risks significantly
- Continued user transparency, consent, and legal compliance are key to success

Conclusion

Problem: Noise complaints are a common issue in shared buildings. These complaints can often lead to disputes, unfair accusations, and unresolved tension between tenants.

Solution: A software-enabled noise detector that will be paired with a mobile or web app to monitor decibel levels, without recording audio. When noise levels are exceeded for an extended period the system will log the event and generate a report for property managers.

Outcome: A more peaceful, quiet, and respectful living environment, driven by transparent data and ethical technology.

Real World Product vs Prototype Table

Logo

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Appendix