Lab 1 - Sapphire Sounds Descriptive Paper

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Table of Contents

Listing of Figures

Listing of Tables

No table of figures entries found.

1 Introduction

According to The American Public Health Association states that "chronic noise, even at low levels, can cause annoyance, sleep disruption, and stress that contribute to cardiovascular disease, psychological disorders, and premature mortality" (APHA, 2021). One source of this noise could be a noisy neighbor. These types of noise disturbances in shared living spaces can lead to conflict or complaints from tenants. Unfortunately, any complaints that are lodged are based on personal accounts without any objective data to back up the claims. This leaves the landlord with no objective evidence with which to resolve the complaint.

1.1   Solution

The solution to this problem would be a sound monitoring system that could validate (or invalidate) complaints placed by tenants. It would measure decibel levels of living units using sensors and keep a historical record of all noise disturbances that reached a threshold for both decibels and length. This would provide landlords with the objective data with which to resolve complaints. The solution would also provide real-time notifications to offending tenants to hopefully prevent a complaint before it happens.

1.2   Sapphire Sounds

Sapphire Sounds is a web-based platform that will leverage noise sensors to monitor decibel levels. Tenants will be able to monitor their own noise levels and will receive notifications if they are being too loud. Any noise violations will also be logged and will be viewable in timestamped reports by landlords. This will allow for landlords to resolve complaints based on objective data.

2 Sapphire Sounds Product Description

Sapphire sounds is a web and mobile application that pairs with decibel monitoring sensors. It will be designed to monitor the noise level of rentals without capturing any private conversations

or audio. If noise thresholds are exceeded, an alert will be sent to the tenant. Reports will also

be generated which can be leveraged by property managers in the event of a complaint from

neighboring tenants. The application will also provide a rewards system that allows for property

managers to reward tenants for keeping their noise levels consistently below thresholds.

2.1   Key Product Features and Capabilities

Sapphire Sounds provides analytical data to resolve noise-based complaints. It accomplishes this

by utilizing decibel monitoring sensors placed within rental properties. If noise levels reach a

certain threshold a notification will be sent to the tenant. The system will also create a time-

stamped report that can be referred to by the property manager in the event of a noise complaint.

This allows property managers to make evidence-based decisions on how to handle the situation.

Privacy is a very important aspect of Sapphire Sounds. Due to this no audio recordings will be

made. The system will only monitor noise levels. Sapphire Sounds will also provide a unique

rewards feature that allows property managers to provide tenants with rewards for consistent

noise level compliance. The team at Sapphire Sounds believes that through both notification to

tenants and the incentive of rewards the number of noise complaints will be reduced, creating

greater harmony in shared living spaces, and in the event of a conflict, property managers will

have the necessary data needed to objectively make a decision.

2.2   Major Components (Hardware/Software)

Sapphire sounds will rely on the following hardware (see Figure 1):

- **Raspberry Pi Zero 2 W:** Serves as the central controller, gathering noise readings and
  transmitting them over Wi-Fi.

- **Infineon CYW43239:** The built-in Wi-Fi chip that enables the Raspberry Pi to stay
  connected.

- **I2C Decibel Sound Level Meter:** Tracks noise level in decibels and communicates with the Raspberry Pi through I2C protocol.

Sapphire Sounds will also consist of the application layer (see Figure 1):

- **Frontend:** A React.js web and mobile interface hosted on Firebase, allowing tenants and property managers to review logs, alerts and reports.

- **Backend:** A Node.js service hosted on render.com that processes incoming sensor data, manages authentication, performs noise analysis and issues alerts.

- **Database:** A relational database using PostgreSQL for storing timestamped noise readings, user information, noise patterns and reward history.

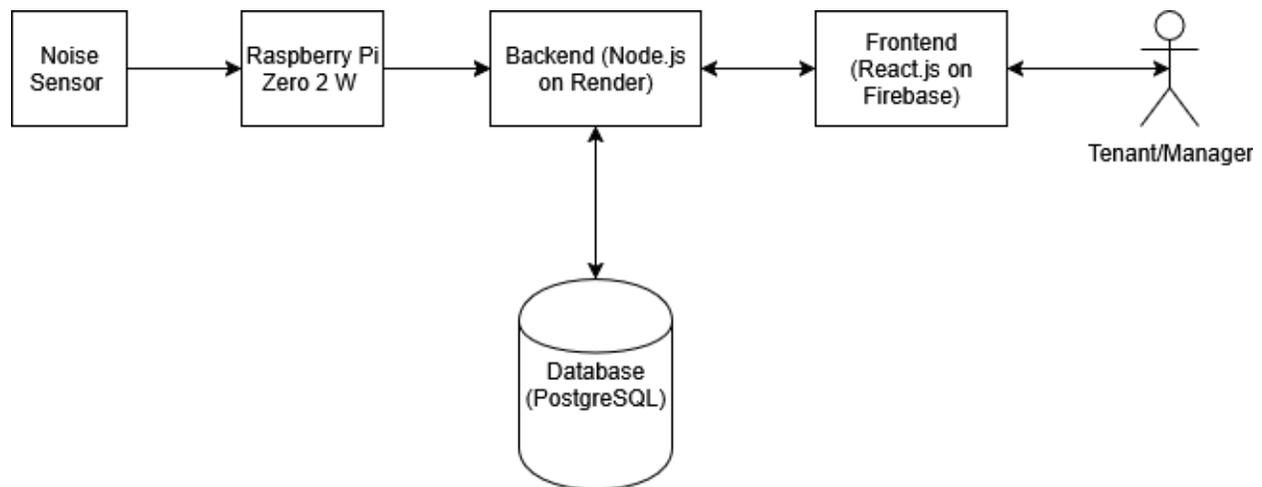- **Version Control:** GitHub for source code collaboration and continuous integration and deployment.

Figure 1: Sapphire Sounds Basic Architecture

3 Identification of Case Study

Sapphire Sounds is designed for two key user groups: Tenants and Property Managers.

- Tenants will be able to track their own noise activity, which will reduce disputes over noise levels with neighbors. Rewards will also be used as an incentive to maintain proper noise levels.

- Property Managers will gain the ability to objectively review any noise complaints and identify any reoccurring offenders.

We believe that the development of Sapphire Sounds is important because noise complaints are among the most common conflicts in multi-unit housing. The current solution relies on subjective evidence to resolve disputes. This leads to a reduction in harmony within shared living spaces. The best solution would provide objective evidence while incentivizing proper noise compliance and Sapphire Sounds will provide these.

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.

5 References

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