Lab 1 – Pest Patrol Product Description

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Contents

List of Figures

1. Introduction

In the year 2022, pests are an unavoidable fact of life. In fact, pest encounters in communities are a common occurrence. Approximately 10% of US households have reported the presence of roaches and/or rats in their place of residence in 2021 (U.S. Census Bureau, 2021). This problem is a widespread issue that impacts all types of communities regardless of their location (Figure 2).

It is important to note that pests can cause more than just an annoyance – they can cause both monetary and bodily harm that costs victims cumulatively billions of dollars. For example, in 2015 John Hopkins stated that Lyme disease alone cost the U.S. healthcare system between $712 million and $1.3 billion a year – which is nearly $3,000 per average patient (Lyme Disease, 2015). Unfortunately, due to the isolated nature of pest encounters and lack of a platform to report incidents, communities lack awareness of the threats in their locations. Pest Patrol will provide a platform for coordinating a community response to pests. The application will allow users to stay informed about pests in their communities with real time reports of pests at specific locations. This will allow users to safely plan outdoor activities and trips. Pest Patrol will also provide a platform for users to communicate with others to share knowledge gained from previous pest encounters and assist users with future occurrences.

2. Pest Patrol Product Description

Pest Patrol will offer many benefits to communities in the struggle of handling pests. The first main benefits will be providing real-time awareness of pest issues and their location by

using community crowdsourcing. For example, if a community member sees a bear at a local park, they can make a post on the app to inform other community members. It will also offer a platform for users to offer guidance to other members of the community on how to effectively manage and resolve pest problems and identify unknown pests. The application will maintain a database of all past reported incidents which will streamline the process of finding effective prevention strategies and solutions to current pest problems. Finally, Pest Patrol will use heat-mapping and predictive modeling. This will allow users to track pest outbreaks and prevent the spread by utilizing preemptive pest control strategies.

The main goals of this application are to make communities safer by minimizing the frequency of unwanted pest encounters and reduce the severity of pest problems that do still occur. It will accomplish this by providing a platform for reporting pest encounters and learning about pests present in a community. Because users will be able to add their exact or general location to a reported incident, other users in the same area can communicate about reports. It will also provide a platform for discussion thread and aggregation of similar reported incidents.

2.1 Key Product Features and Capabilities

The first feature to mention about Pest Patrol is that it is a web-based application, so it will support multiple platforms. Because it is web-based, it will be accessible to all users regardless of the type of device used to access the application. Although it will be accessible to all devices, Pest Patrol users without an account will only be able to use the application in a "view-only" mode. In order to use the "interactive" mode, users will need to make an account by

registering with a valid email address and choosing a password. Once users have an account, they will be able to make reports and interact with other users.

The first interface that loads upon logging into the application will be the Dashboard module. This page will provide access to all the other features of the application with 3 different view options. The first view option is the “incident map” which will have a map view of all reported incidents near the user's location. The second view option is “discussions” which will contain a list of all the discussion threads related to reported incidents near the user’s location. The third view option is “Hybrid” which will display both the incident map and discussions views simultaneously.

The incident map will display reported incidents based on the user’s location. The PC version of Pest Patrol will allow users to set their preferred community to determine the location. In contrast, the mobile version of the application will utilize the user’s current physical location to determine the location. Additionally, which reports are displayed will be customizable through the “Search Options” feature. Users will be able to set the scope of the map by choosing the geographical area radius of incidents to be displayed. Users will also be able to determine which reports are displayed based on the time/date they were reported, the type of pest involved in the report, and the user that made the original report. Additionally, the incident map will have an alternate “Heat Mapping” view with the aim of observing the trends of emerging pest issues in a community. Registered users will be able to add a new incident to the map by making a pest report. When a new report is made, other nearby users will receive mobile alerts about the new

encounters in their vicinity. The options for receiving alerts will be customizable in the user's profile settings. The user's profile settings will also allow for other customization options including adding their name, updating their username, adding a profile photo, and changing their password.

The "Thread Activity" feature will compile discussion threads that the user created or has participated in for ease of access. Users will also be able to subscribe to discussion threads. The "Recent Activity" feature will allow users to see recent activity near the users location including newly reported incidents, newly discussion threads, discussions with new activity, and preemptive alerts to the user on potential problems to anticipate - based on machine learning analysis of historical data. Finally, the "Direct Messaging" feature will allow users to directly message other users separately from the discussion threads. This is directly related to the "Community" feature which will allow users to add other users as friends, follow other users, or report others for inappropriate behavior.

2.2 Major Components (Hardware / Software)

The Pest Patrol application requires minimal hardware to run. The Major Functional Component Diagram can be seen below in Figure 1.

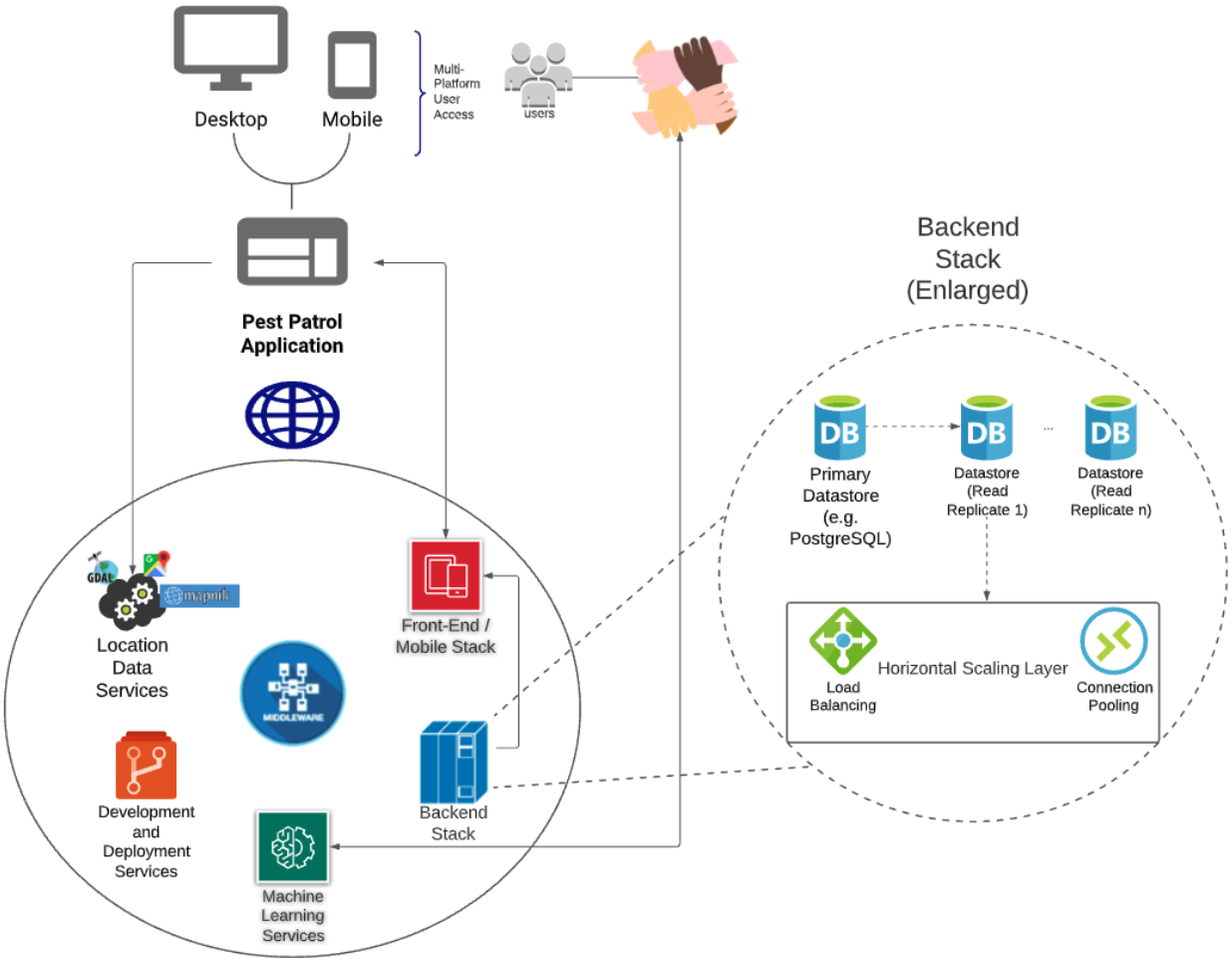

Figure 1. Pest Patrol MFCD

Hardware

- *Mobile Application* - Internet enabled mobile device with camera
- *Desktop Web Application* - Computer with access to internet, keyboard, mouse, and camera

Software

- *Web browser* – Pest Patrol will be accessible on numerous different devices and browsers

- *Front End:* The application will use a framework that creates a responsive JavaScript experience (Angular.js / TypeScript)
- *Middleware:* The application will use Node.js to serve data from the backend into the UI
- *Code editor:* Microsoft Visual Studio Code will be the predominant code editor used to develop the application
- *Repository:* The application will have a GitHub Repository for version control and collaboration.
- *GraphQL:* The application may eventually utilize NoSQL/GraphSQL

Database

The Pest Patrol application will be hosted on Google Cloud Platform (GCP) with the below stack:

- *PostgreSQL* - for transactional data
- *Cloud Storage* - for Blob Data
- *Big Query* - Data Ware

Runtime / CICD / Microservices

The application will also utilize the below services as part of GCP:

- App Engine
- Cloud SQL Instances
- Maps APIs and Services
- AI Platform (Stretch)

3. Identification of Case Study

Pest Patrol is designed for individuals who have interactions with pests. The main groups likely to utilize this application are community members, hikers and campers, outdoor businesses and cities. The application will allow community members to report pests to the rest of the community, view alerts of pests in their area, and communicate with other community members about on-going pest issues to aid in a collaborative community response. Pest Patrol will benefit hikers and campers by allowing them to preemptively view the incident map of their destination for pest reports. This will allow them to prepare for potential pest interactions or avoid certain dangerous locations. The application will benefit outdoor businesses by allowing them to check for reports of dangerous pests in their business locations to minimize danger to the employees and customers. Finally, Pest Patrol will allow cities to track ongoing pest issues and create plans to address problems in their communities.

The overall purpose of Pest Patrol is to allow users to report, monitor, and communicate about pests and their locations. This will also aid in users coordinating community-based solutions to ongoing pest problems.

Other groups that will benefit from Pest Patrol include pest control companies, HOAs, government agencies and researchers. Pest control technicians will be able to view nearby homes and businesses that are dealing with pests through the incident map, and then reach out to offer their services through discussion threads or direct messaging. HOAs will be able to monitor the current pest activity in their communities and reach out to impacted individuals to offer support or warnings. Government agencies and researchers will be able to use the collection of data provided by Pest Patrol to track pest populations.

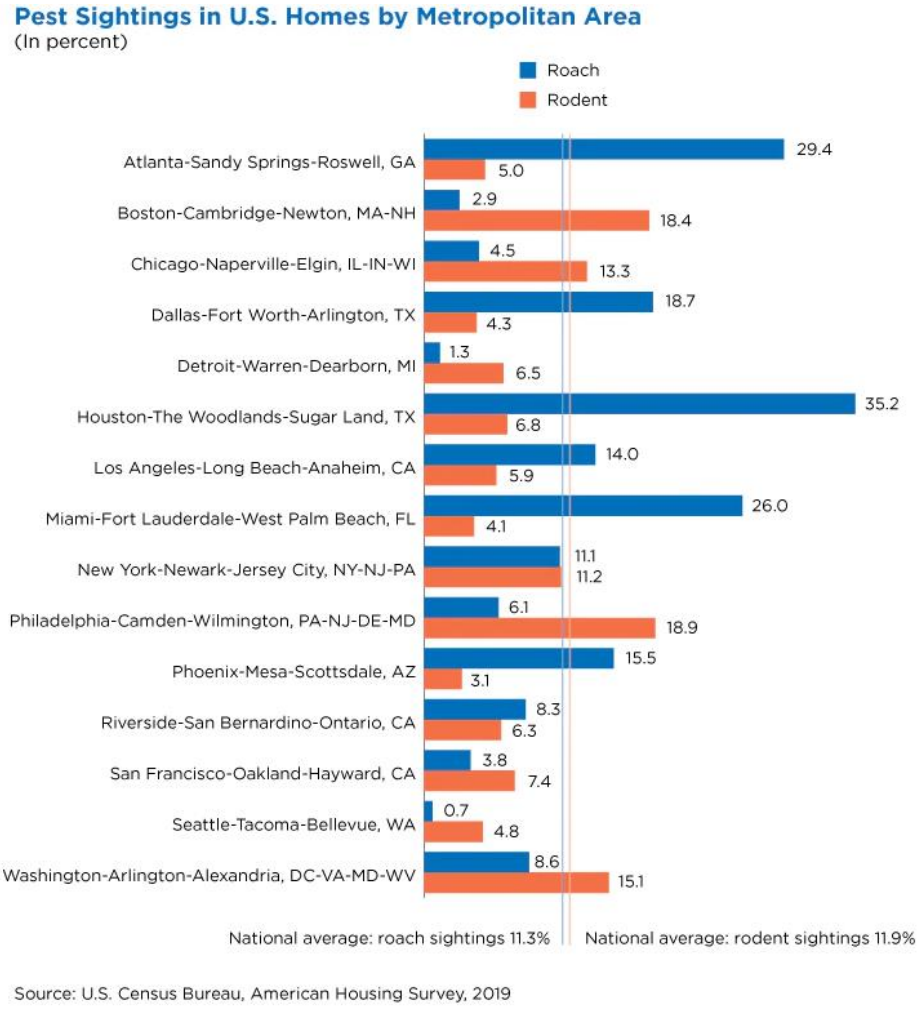

Figure 2. Pest Sightings in U.S. Homes by Metropolitan Area

4. Pest Patrol Product Prototype Description

4.1 Prototype Architecture (Hardware/Software)

4.2 Prototype Features and Capabilities

4.3 Prototype Development Challenges

5. Glossary

Pest: Any animal or plant harmful to humans or human concerns

Community Member: A member of a community, see Community definition

Community: The people with common interests living in a particular area broadly the area itself

Incident: An occurrence or sighting of a pest reported by a user

Geo-targeting: Method of determining the geolocation of an application user and delivering different content to that visitor based on their location

Geo-tagging: The process of appending geographic coordinates based on the location of a mobile device

Bot Moderation: The automatic screening of user content to ensure proper user behavior

6. References

Lyme Disease Costs Up to $1.3 Billion Per Year to Treat, Study Finds. (2015, February 5). https://publichealth.jhu.edu/2015/lyme-disease-costs-more-than-one-billion-dollars-per-year-to-treat-study-finds

U.S. Census Bureau. (2021, April 21). Residents of 14 million housing units reported seeing roaches, 14.8 million saw rodents in last 12 months. https://www.census.gov/library/stories/2021/04/how-many-american-homes-have-pests.html