Lab 1 – Pest Patrol Description

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Contents

Figures & Tables

1. Introduction

Pests have been around people for as long as history has been recorded. Most people have just accepted these pests as an everyday occurrence, even though most of the time they cause no harm there are cases where they can cause physical and monetary harm.

The more common pests including rats, mosquitos, ticks, and cockroaches are known to carry diseases. Some of the diseases that these pests carry include Hantavirus and the plague being carried by rats, Lyme disease and Anaplasmosis by ticks, Malaria and the Zika Virus carried by mosquitos and Cholera and Dysentery commonly carried by cockroaches. In the United States there are around 2,000 diagnosed cases of malaria (CDC, Malaria, 2015), around 20,000 – 30,000 confirmed cases of Lyme disease per year (EPA, Lyme Disease, 2016). These disease on average cost the United States an enormous amount of money to treat. For Lyme disease alone it costs the United States anywhere between $712 million to $1.3 billion a year to treat (John Hopkins, 2015). These are just some of the known costs for treatment of pest delivered diseases.

Personal injury is not the only problem pests cause people. Pests infest and wreak havoc to people's homes and property. Termites are one of the leading pests that cause damage to personal property. In the United States termites damage approximately 600,000 homes each year, with an estimated $5 billion annually to control and repair damage caused by the termites (Orkin, 2022). On average, homeowners who find termite damage will spend an average of $3,000 to repair any damages (Orkin, 2022). Another pest that infests houses and cause damage to homes are cockroaches. According to the 2019 American Housing Survey (AHS), there were about 2.9 million reported sightings of roaches in their homes (U.S.C Bureau, 2021). The roaches have adapted to living alongside humans within their homes. The problem with the roaches is that they

can cause health problems such as triggering asthma and carrying Cholera and Dysentery. With the average cost of cockroach removal costing between $100 and $400 for a single treatment with the average cost being somewhere around $150, with severe infestation treatment costing as much as $6,000 (T.O.H.R, 2022). These unwanted pests are going to continue to burn holes into homeowners' pockets with continuous encounters.

These pest encounters are mostly preventable but still occur due to lack of awareness, communication, and coordination by communities, cities, and businesses. If a community member had a termite infestation and no other community member knew about it, then the whole community could be at risk of getting termites. The same problem applies to cities and businesses, if no one knows about the problem how are they supposed to prepare against it. Communication is key when it comes to preventing pest problems. When community members, cities, and business communicate about current or potential pest problems it opens up avenues to solve the pest problem. Proper coordination of community members, cities, and businesses allow for the adequate allocation of resources to eradicate the pest problems in the most efficient manner possible.

Pest Patrol is a web application designed to protect communities from pests by making it possible to proactively respond to their presence. This is done by giving communities, cities, and businesses the ability to efficiently communicate about pest related issues by using message boards on specific pest encounters or direct messaging. Pest Patrol also giving users the needed awareness of pests around them by having interactive heatmap capabilities, giving community members the information needed prevent pest encounters. With proper communication and awareness communities are able to coordinate efforts into solving the pest problems. With the

constant aggregation of knowledge gained form previous encounters users are able to help each other with any future occurrences of pests.

2 Pest Patrol Product Description

Pest Patrol is a cross-platform web application designed to keep people in the know about potential pests in their communities. The Pest Patrol web application has multiple features to keep the community knowledgeable about potential threats around them. This is accomplished by having a streamlined interface for reporting and learning about pests encounters in a community, enabling users to tie reported incidents to their exact location, provide a means for users to communicate with one another on any reported incidents and directly aggregate reported incidents and related discussion threads.

2.1 Key Product Features and Capabilities

Pest Patrol will be an online web application available on both PC and mobile devices. The web application will be supported on any device that is able to connect to the internet and have a steady connection. Pest Patrol will be available to any user either through the use of a personalized account or the use of a guest account. The personalized account gives users the ability to customize what alerts they wish to receive, by filtering specific pests they wish to get notified about or if a pest encounter is within the users set radius around themselves. The guest account will still allow the user to see the same information about recent pest activity but without the ability to customize searches post any pest activity/sightings.

One of the main features of Pest Patrol are the pest alerts. Pest alerts are notifications that get sent to the user whenever a new pest incident has been posted within the user's vicinity, allowing them the opportunity to avoid a pest encounter. The pest alerts are sent to the user's mobile device alerting them of a potential pest encounter. The user is then able to open the

notification, which will open the Pest Patrol web application showing the user the specifics on the pest encounter. The user is able to customize these pest alerts to only show specific pests or only show pests within a certain radius of the user. The pest alerts will not be available for the PC, only for mobile devices.

Once logged into Pest Patrol, the main interface of the application, the dashboard, will be present for the user. The dashboard is the main piece of the application that provides access to every feature within Pest Patrol. The dashboard can be set to three distinct display modes: Incident Map, Discussion Boards, and Hybrid. The Incident map displays the map of the user's set community and the reported pest incidents. While the Discussion boards display the threads relating to the reported incidents. Hybrid is a combination of the Incident map and the Discussion boards giving the user the ability to view them both together.

The Incident map is the main interactive feature of Pest Patrol, giving the user a complete view of all the reported pest incidents in their vicinity. By viewing the map, the users will be able to get exact location data on where pests have been spotted and what type of pest it is. By clicking on any of the reported incidents the user will be able to view detailed information on the pest's location, pest type, time it was recorded, and any notes left by the reporter. Users are able to customize the incident map to their liking by placing a filter on what information they wish to view, whether it be specific types of pests, radius around the user, or age of the reported pest sighting, the user has full control of what they want to view.

The Discussion board gives users the current information about any recent pest incidents. The Discussion board is the area of Pest Patrol where users are able to talk about the pest incident and receive community feedback. All recent discussion boards are available for every user to view, whether it be to see if the situation has been resolved or to gain information on how

to clear their own pest problems. The users are also able to filter the discussion board as they would the incident map, allowing the user to view only what they want to view.

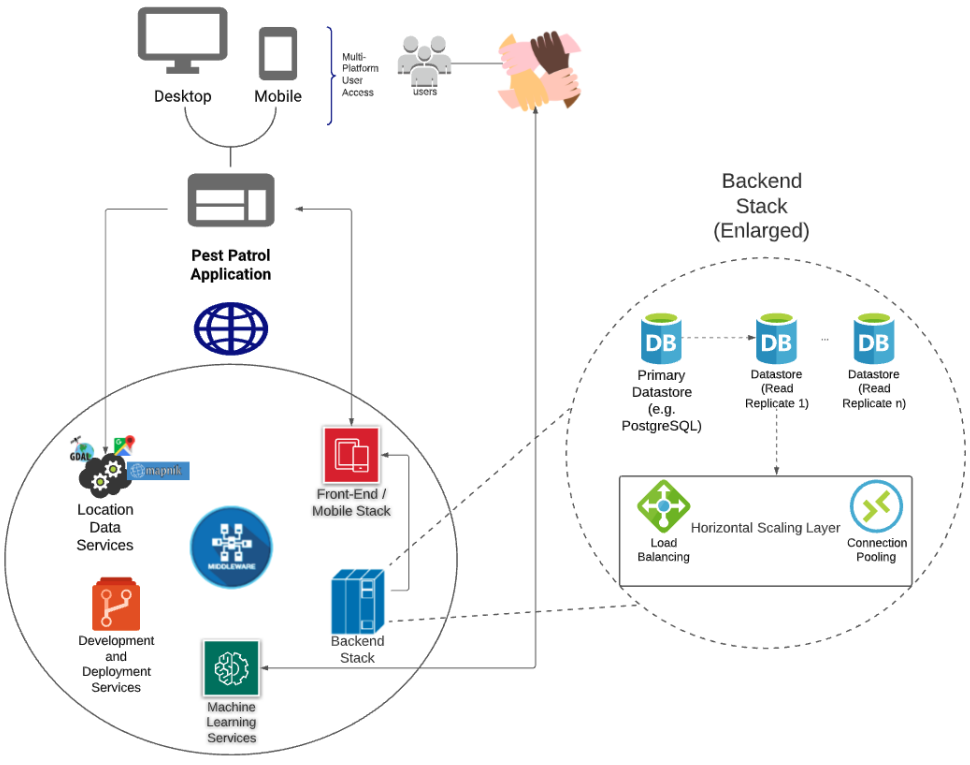
The social element of Pest Patrol comes in the form of direct messaging. Direct messaging is done like any other social media allowing users to communicate privately without having to go through the discussion boards. Users are able to add each other as friends for ease of contact along with blocking each other in the case of abuse of the direct messaging system.

2.2 Major Components (Hardware/Software)

Pest Patrol is a web-based application that can be accessed from either a PC or a mobile device. The Pest Patrol architecture is service-oriented consisting of a frontend UI that is presented to the user as the Pest Patrol web-application and a backend stores the data input from the frontend into google based cloud storage solutions.

Figure 1

Pest Patrol Major Functional Component Diagram



The frontend UI will be developed using Angular.js to create a reactive web-application. This is done to ensure the best user experience whether using the desktop version of Pest Patrol or the mobile version. The location service data used by the application is required to give accurate positions of the pest encounters and without it the web-application would only be able to give rough estimates of the location.

3 Identification of Case Study

Pest Patrol's main user demographic are members of a community, hikers/outdoor enthusiasts, businesses, cities, and homeowner associations. Community members would be more likely to report a pest incident to warn their fellow community members and seek help on managing the pests within their community.

Since hikers/outdoor enthusiasts are more likely to encounter pests in their activities. Pest Patrol would allow them to report the pest encounter, warning potential hikers or people doing outdoor activities to the potential threat they may encounter in the area.

Businesses would be able to use the web-application to scout for potential clients. A pest removal business would be able to look for communities with high encounter rates with pests, allowing them to solicit their business to the community. This is not the intended purpose of Pest Patrol, but businesses are a secondary customer of the web-application.

Cities and homeowner associations are also secondary customers. Since Pest Patrol gives community members the ability to report, monitor and communicate pest activity in their community, cities and homeowner associations are able to collaborate with the community to solve the pest problems. Doing so would make the community members benefit since they got

the help, they needed to fix the pest problem and cities and homeowners associations would benefit by having happier community members and possibly increasing the value of the property.

Pest Patrol will initially be tested using a small group of volunteers from a small community. The community members would then be asked to go about their days as normal, but to use the Pest Patrol web-application whenever they come into contact with a pest. After a set amount of time the data that the community gathered would be harvested and the testers would be given a survey asking about usability and usefulness of the information available on the web-application.

4 Pest Patrol Product Prototype Description

Pest Patrol was designed to provide people and communities informed about potential pests around them. The prototype for Pest Patrol will not contain every feature that was envisioned, the key features needed to demonstrate how Pest Patrol is a solution to the described pest issues.

4.1 Prototype Architecture (Hardware/Software)

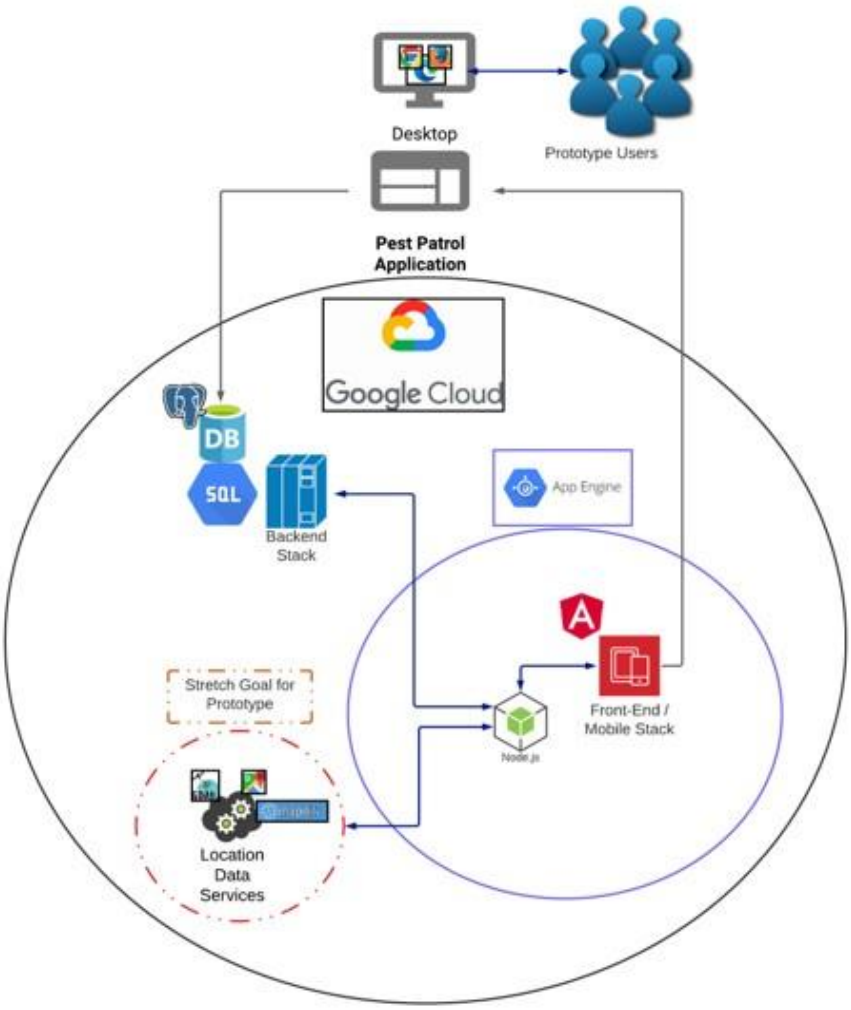
The prototype for Pest Patrol will include the following components shown in Figure 2. The prototype will have the two main functionalities separate unlike the real-world product which would allow users to view both the incident map along with the dashboard simultaneously. The web application will still be compatible with home computers along with any mobile device able to connect to the internet.

The Pest Patrol web application will be split into three distinct sections, Front End, Middleware, and Back End. The Front End will consist of an Angular Web application running on the Google App Engine within the Google Cloud Platform. As shown in Figure 2, the Front End will connect to the Back End through the Node.js Middleware that also runs on the Google

App Engine within the Google Cloud Platform. A stretch goal for Middleware is to have Location Data Services integrated into the Middleware. The Back End is a PostgreSQL instance of Google Cloud managed service that holds the data for our prototype. A stretch goal for the Back End is to create years' worth of mock that would allow for the demonstration of searching for noted pest incidents from within the web application.

Figure 2

Prototype Pest Patrol Major Functional Component Diagram



4.2 Prototype Features and Capabilities

Most of the real-world product functionality will be fully implemented or partially implement with some functions eliminated due to time constraints, as shown in Table 1. Some of the functions that have been eliminated from the prototype include the Hybrid mode along with functions that pertain to the users account authentication and password recovery. As for the partial implementation of having the application be web and mobile compatible, mostly focusing on the web side of development and working toward making the application more accessible to the mobile market after getting a firm grasp on the PC development.

The front end will be capable of providing a responsive web application with emphasis on a higher quality UI/UX experience. This responsive front end will also be able to demonstrate Pest Patrols key features being fully implemented including the incident dashboard, incident map, and incident filtering. While also having partial implementation of incident reporting and an incident heat map.

The back end will be able to support a relational database management system that provides timely query results, having the data managed by the services within the Google Cloud Platform. A perk of having all the data being handled by Google Cloud SQL is that the security of the applications data will be managed by Google.

Table 1

Pest Patrol RWP vs. Prototype Features

Function	Real World	Prototype
General		
Web and mobile compatibility	Fully Functional	Partially Functional
Dashboard	Fully Functional	Fully Functional
Hybrid Mode	Fully Functional	Eliminated
Authentication and Identification	Fully Functional	Eliminated
Password Recovery	Fully Functional	Eliminated

Incident Map		
Incident Map	Fully Functional	Fully Functional
Incident Reporting	Fully Functional	Partially Functional
Ad hoc Incident Filtering	Fully Functional	Fully Functional
Heat Mapping	Fully Functional	Partially Functional
Discussion View		
Discussion Thread View	Fully Functional	Fully Functional
Expanded discussion view	Fully Functional	Fully Functional
Follow/Subscribe to discussion thread	Fully Functional	Fully Functional
Discussion thread creation	Fully Functional	Fully Functional
Reply to discussion thread	Fully Functional	Fully Functional
Provide positive/negative feedback to threads	Fully Functional	Fully Functional
Pest Alerts		
Pest Alerts	Fully Functional	Partially Functional
Alert customization	Fully Functional	Partially Functional
Community		
Search for user	Fully Functional	Fully Functional
Add friends	Fully Functional	Fully Functional
Report Users	Fully Functional	Fully Functional
User reputation system	Fully Functional	Eliminated
Automated Moderation (ML)	Fully Functional	Eliminated
Hide flagged content	Fully Functional	Fully Functional
Account suspension	Fully Functional	Fully Functional
Flag inappropriate content	Fully Functional	Fully Functional
Content removal	Fully Functional	Fully Functional
View flagged content	Fully Functional	Fully Functional
Block user	Fully Functional	Fully Functional
Content search	Fully Functional	Fully Functional
Recent Neighborhood Activity	Fully Functional	Fully Functional
Direct Messaging	Fully Functional	Fully Functional
New thread activity notification	Fully Functional	Fully Functional
New direct message activity notification	Fully Functional	Fully Functional
New incident notification	Fully Functional	Fully Functional
AI generated notifications (ML)	Fully Functional	Eliminated
Notification customization	Fully Functional	Fully Functional
Predictive Modeling (ML)	Fully Functional	Eliminated

4.3 Prototype Development Challenges

Some of the challenges that are expected to be encounter while completing the prototype have to do with the front, middle and back end of the prototype. For the front end, the use of complex web application framework, for our case Angular, while also having the ability to write code in type-safe JavaScript. Also needing to familiarize ourselves with the MVC architectural pattern along with style sheets and general HTML. For the middleware, being able to write APIs

that are able to connect the front end to the backend database server. Lastly for the backend being able to understand and follow the best design practices for a relational database management system.

5 Glossary

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

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

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

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

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

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

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

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