Lab 1 – Pest Patrol Product Description

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1. Introduction

Pest encounters in communities are a common occurrence. Still, community awareness and an informed collective response rarely occur due to the isolated nature of these experiences and fragmented means of reporting.

Pests have always been a nuisance and problem for the human race. For good and evil, pests are a part of this world and are here to stay. Pest plays its role but sometimes causes damage or harm to us or our property. Residents of 14 million housing units reported seeing roaches; 14.8 million saw rodents in (the) last 12 months. [10] Approximately 10% of US households reported the presence of roaches and/or rats in the home.[4] On average nationwide, professional rodent removal costs between $95 and $235, with the average cost to homeowners being $165.[11].
Termites infest over 600,000 homes each year, resulting in 5 billion dollars of property damage. [5] The average cost of termite treatments and damage repairs is more than $9,000 [12].

These numbers are not trending down; in fact, most available evidence suggests the prevalence of many pests will only increase in the coming years due to warmer winters. [1] Data also suggest if the climate continues warming in the coming years, as many scientists predict [2], pest populations will also continue to grow. Since temperature is the most important environmental factor affecting insect population dynamics, it is expected that global climate warming could trigger an expansion of their geographic range, increased overwintering survival, increased number of generations, increased risk of invasive insect species and insect-transmitted plant diseases, as well as changes in their interaction with host plants and natural enemies [13].

Currently, 4 billion people live in urban areas — 54% of the global population. It is forecast that by 2045 this number will increase by 2 billion. Urban areas create a complex mix of microhabitats and a ‘heat island’that has temperatures up to 12°C above surrounding areas. Human activities can provide a ready abundance of food and water in addition to the protected shelter free from many natural predators that restrict populations in pests’ original habitats. [14]. Humans are also expanding into formerly wilderness areas; encounters with more significant and more dangerous pests will also continue to increase. [9]

A typical homeowner doesn’t have a reliable way to know if a pest infestation is near them. They rely on technologies like Facebook and Next-door, which at best would only inform a homeowner if there were one, maybe two houses near them that had a pest problem. The homeowner has no way of knowing how big a pest problem is or if it is a one-off occurrence. There is no one-stop-shop to show live data of pest encounters in a defined space. Large-scale coordinated strategies have been demonstrated to be successful against pests. We plan to facilitate this coordination by providing an alleyway for effective communication, awareness, and coordination among community members. Pest Patrol will be a mobile and PC application that will allow individuals to report, monitor, and communicate the overall pest activity in their community and allow users to coordinate a community-based solution to pest problems.

2. Pest Patrol Product Description

Pest patrol uses community crowdsourcing to provide real-time awareness of pests issues and their location. Users can offer guidance to other community members on how to effectively manage/resolve pest problems and identify unknown pests. It maintains a collective knowledge base of all past reported incidents to streamline user efforts in finding effective prevention strategies and solutions to current pest problems. The app will also use heat mapping and predictive modeling. Hence, users are aware of significant pest problems within their community and know when seeking assistance from pest control companies is necessary.

The goals of Pest Patrol are to make communities safer by minimizing the frequency of unwanted pest encounters and reducing the severity of pest problems that do occur.

We will provide a streamlined interface for reporting and learning about pest encounters in a community. Enable users to tie reported incidents to their exact location. Provide a means for users to directly communicate with one another on reported incidents. Aggregate reported incidents and related discussion threads.

2.1 Key Product Features and Capabilities

Pest Patrol will include PC and mobile versions of its software and support Windows and Android operating systems. A valid account tied to a valid account email address is required to use any interactive aspect of the application. The application will be view-only without an account. The Pest Patrol application will offer a variety of features to help people access the information they need. When a user logs on, they will start at the dashboard. Here the user will have the ability to access all the features/modules of the application. There will be three view modes of the application. The incident map will show a map of reported incidents. The discussion will list discussion threads related to the reported incidents. Users can seek help from the community and offer guidance/assistance. There can be multiple of these discussions. Hybrid will simultaneously display the incident map, discussion threads, and an expanded view of the currently selected discussion thread. The user can then switch views to show just the incident map. The map will display reported incidents based on the user’s location. The location on a PC will tie the user's location to the user's selected community. The area on the mobile version is connected to the user's physical location. The incidents are customizable based on location, time/age, pest type, and the user that submitted the incident. The user can add new incidents straight from the incident map. The map also offers a heat-mapping feature that will show hot spots based on the age of the pest activity and the type of pest and highlight significant emerging pest problems. Users will receive customized mobile alerts about the recent pest in their vicinity.

Users will have quick and easy access to the threads related to the user. Users can also subscribe to other threads. The application will compile all recent events in the user's community and display them. These include new reports, new decision threads, and preemptive alerts to the user on potential problems to anticipate. The user will be given the ability to direct message,

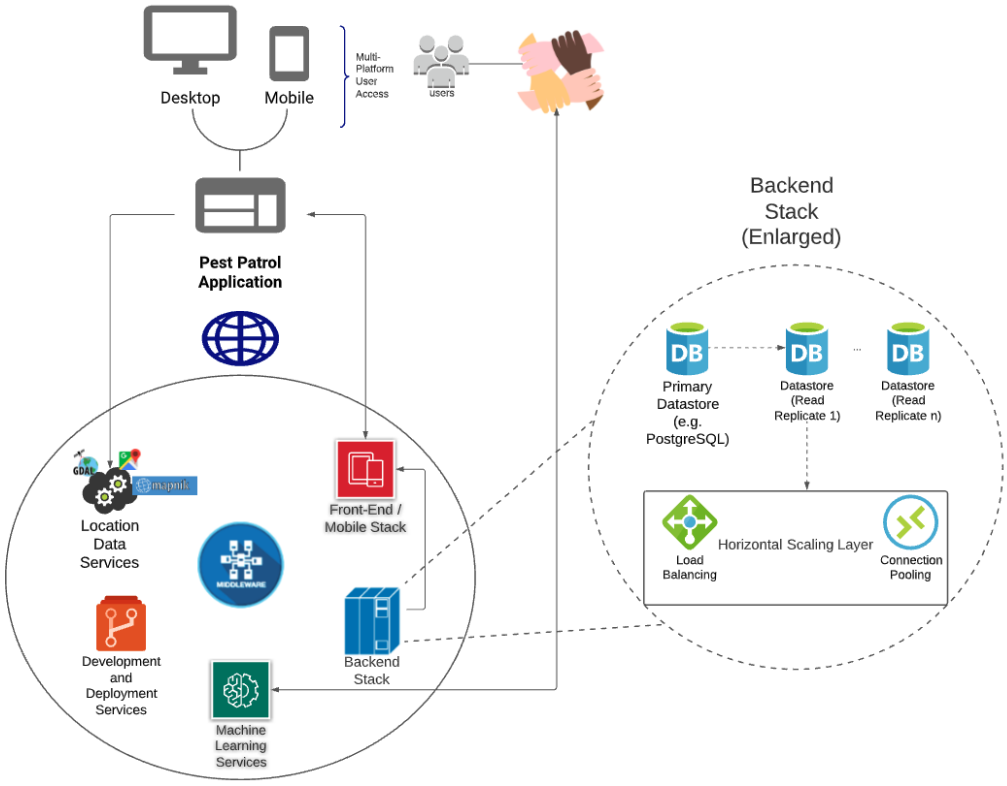
somebody without having to create a public thread. Users will be part of their community by being able to follow/friend each other or report others for inappropriate behavior. The user will be able to customize their profile by adding information like their name, photo, username, and password. They will also be able to customize their display and alert settings. The application will offer a search option by using the ad hoc method to filter items on the incident map without needing to modify profile settings.

2.2 Major Components

Below is Pest Patrol's major functional component diagram (figure 1).

Figure 1

Pest Patrol Major Functional Component Diagram



The application will be a web app that can be hosted on a web browser on a mobile internet-enabled device with a camera. It can also be hosted on a desktop with access to the internet along with a keyboard, mouse, and a camera or saved images. The front end will be run primarily on JavaScript utilizing Angular.js. The middleware will use Node.js, which will allow communication from the database to the application. The code will be written and debugged into Microsoft Visual Studio Code. PostgreSQL will be used for transactional data. The repository will be set up and managed using the Gitlab tools. The

backend will utilize Google cloud storage and tools for saving, managing, and maintaining the data. Machine learning will also use the Google family's Google TensorFlow platform. Staying in the Google family, data ware will be handled by Google's Big Query, and blob data will utilize Google's cloud storage.

3. Identification of Case Study

Pest Patrol is designed to bring awareness of pests in a given area. That being said, it has a significant impact on community members. Pest Patrol provides an avenue for community members to report pests in their regions. It also gives the community member the ability to view alerts in their assigned area. This helps keep community members safe from pest-related threats or pest-related injuries.

Pest Patrol can be vital for hikers and campers with the widespread data collected. Hikers and campers can view an area before they travel and even while at their site to know what pests have been seen near them. This will help hikers, and campers better prepare and determine what they need to bring to deal with said pests. This data can also help outdoor businesses by being a tool for checking for pests in a current or potential work area. This will help mitigate negative impacts due to pests. It will also help keep the employees and clients safer by allowing the business to be better equipped with information or tools to deal with the pest they may encounter. Cities can also leverage the data to help better serve them. With all the data coming in from Pest Patrol, cities can deal with a pest within a community. They can get in front of an outbreak and better equip employees and community members with the tools and information they may need.

Pest control companies can leverage this data for their marketing strategies. They can offer more precision in their pest mitigation tactics and be able to stop pests more efficiently. HOAs can monitor the status of pests in the communities they are responsible for. Government agencies such as the United States Fish and Wildlife Service could utilize data collection for tracking invasive species. Researchers could use the collected data for population tracking studies with geographic data.

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

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