SRS Template

Product Owner	Maochuan Wang	
Engineering Lead	Yaxuan Zhang	
Required Approvers	Lucas Rosen	Bryan Runck

User Statement 2
My name is Shaul and I work for the Minnesota Department of Natural Resources. I'm reaching out on behalf of MNDNR and the Department of Agriculture for you to help us build a pipeline to prioritize Brown Marmorated Stinkbug Invasive species monitoring. It's causing a lot of damage in other states and has been recently introduced into Minnesota. The online system needs to show a map and ranked list of cities that we should prioritize for monitoring and detection for spread on a regular basis across Minnesota. Can you help us with this?

Also, we have some other developers that want to get the results in real-time too. They can receive geojson. Can you do that?

Overview

The main goal of this project is to build an interactive web map that can give users visualization of real-time monitoring of Brown Marmorated Stink Bug in the state of Minnesota, with a rank list of cities that we should prioritize for monitoring and detection for spread.

The objectives of this project are as follows:
- Real-time Map visualization
  - A thematic map with updated information from the data stream
  - Map theme will update according to the data we receive
  - User can retrieve the historical data by dragging the time bar
- Insert, revise, download, and delete data records
  - Users will be able to insert, edit, download, and delete tables they wish to upload and manipulate within the map service
  - Different users may have different access to the above operations based on the user level (e.g., administrator or viewer)
- Basic statistical description and text description
  - This web service will provide statistical descriptions such as mean, median, max, min…etc for each dataset, and each table also comes along with a text description.
- Monitoring Priority Tool

- ○ The web service will provide different monitoring priority levels based on the well-defined priority measurement
  - ○ The web service will show the hotspot of invasive species across different locations and times
- ● Simple geospatial analysis
  - ○ Users will be able to do spatial analysis within the web service using tools such as buffer analysis, and simple modeling if possible.
- ● Prediction modeling spreading (space/space-time)
  - ○ Ideally, we would like to add features that can predict the growth of models and how it utilizes space/spacetime tools.

Problems:

Time: Given only 3 months of time to build this web service. Time is very limited and an important factor for this project.

Resource/Tools: This project will be using lots of spatial technologies and web tools that could make it possible. There are limitations on the number of tools available, such as the cost of APIs, system compatibility…etc.

Complexity: This project will touch on many different aspects of software development. Such as writing python scripts, ArcGIS servers, Javascript, HTML…etc. The level of complexity could be exponentially high for us to finish this project. In addition, there are many logistic limitations in building web applications due to the complexity of the data (real-time, by cities, ranked…etc).

Who it directly affects:

- ● DNR, non-profit organization
- ● Field technician
- ● Researchers
- ● Collaborators

Why important to solve for us:

Maochuan Wang and Yaxuan Zhang both have significant experience with programming and data analysis, especially when it comes to geographic data collection manipulation and web building. In addition, invasive species pose a significant threat to the local ecosystem that would need to be addressed immediately. Building these web services applications, this project would benefit both Maochuan and Yaxuan to utilize their skill sets in some real-world problem-solving applications.

Guiding Obsessions:

- ● Easy to use user-friendly interface with eco-friendly aesthetic.

- Complex data manipulation functions with easy-to-understand instructions.
- Successfully display real-time data with an updated map that refreshes each hour

Motivation

Invasive species are detrimental to our ecosystem. It affects the biodiversity, food chain, and local biological niche. In order to preserve the natural beauty of Minnesota and its ecosystems' stability from attacks from invasive species, building a real-time update of invasive species monitoring web application could be a crucial step to preventing ecosystem destruction. We expect this web service to be a representation of a map with updated real-time data that alters the representation of the map. This web service will impact the local biodiversity of Minnesota, and benefit it from further being attacked by invasive species. It was asked by Shaul from the Minnesota DNR. We believe he could provide us with some background information and possibly data samples from monitoring stink bugs. The other partners could be Esri and ArcGIS software suites.

Definitions

Web Services: A web service is any piece of software that makes itself available over the internet and uses a standardized XML messaging system. XML is used to encode all communications to a web service. For example, a client invokes a web service by sending an XML message, then waits for a corresponding XML response. As all communication is in XML, web services are not tied to any one operating system or programming language—Java can talk with Perl; Windows applications can talk with Unix applications.

Streaming Data: Streaming data is data that is continuously generated by different sources. Such data should be processed incrementally using stream processing techniques without having access to all of the data. In addition, it should be considered that concept drift may happen in the data which means that the properties of the stream may change over time.

Scope

Functional Requirements

Hardware/Firmware:
- General
  - Google cloud Virtual machine with at least 8 GB of RAM and at least 100 GB of disk space
- Sensors
  - Invasive species monitoring devices
  - High-resolution cameras
  - GPS location
- Logger

      ○   On-device logging of data and metadata

Software
- Web application
  - ArcGIS Online
- Smartphone or other portable device application

Non-Functional Requirements

- Usable by someone with a high school education
- Do not share user's location information and other sensitive information
- Battery saving option on portable devices

Out of Scope Requirements

- Real-time data pipeline from outside Minnesota
- Species data other than stink bug
- Analyze data other than tabular and vector data
- Display data that are not related to detection and monitoring (elevation, weather, demographics…etc)

Persona Acceptance Criteria

As a geospatial developer I
- Require the understanding of users' needs and design the applications in accordance.
- Require product to work as expected without any major errors.
- Provide maintenance and support of the software and mapping systems.
- Require to store data efficiently and securely

As an Operator I
- Require the service is always up and running without major delays in data transmission and streaming to this web service.

As an end user I
- Require the interface is user friendly and easy to access
- Require the software to be secure and protect sensitive information from unauthorized access
- Require the software to include the basic functions as in the user statement

Open Questions

- How to control data quality if we allow multiple users to write the data?
- What is the optimal geographic scale(s) for the analysis and monitoring prioritization?

Dependencies

- Google Cloud
- ArcGIS online
- Javascript, HTML, CSS
- ArcGIS server
- Python
- SQL
- Linux

References

https://www.eddmaps.org