Waterfowl Travel: Team Iteration 2 Report

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Prepared by the students of CSC 4610 – Fall 2024

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Stories Identified:

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- SPIKE: As a developer, I want to learn the ways of publishing a domain through wix and web management so that I can ensure the website is well kept/managed. - Jacob Sullivan (New/Done) [5pts]
    - This story involved researching and producing an estimate of how much the total would be to run this project for the client: hosting data, map API costs, and hosting the website in general. Also, the process of how this project would be given was discussed with the client.
- As a developer, I want to be able to pull open-source weather data so that I can have an organized way to pull the data for the map. - Kenny Adams (Done) [13pts]
    - The purpose of this story was so that Kenny and Breanna could automatically acquire new data for use in R. Kenny was given the goal of pulling all the weather data so that Breanna could use it. There were multiple sites in contention for where we would be pulling the data such as OpenWeatherMap and WeatherStack. However, due to input from our client, we landed on the National Weather Service. To do this, Kenny had to write an R code based on the NWs' given API call that would sort through the data pulled and return the relevant data.
- As a user, I want to be able to interact with the Kepler map on the website so that I can navigate the locations of the predicative duck data. - Jacob Sullivan (Done) [5pts]
    - For the story above the function of interacting with a map and putting a sample of historical data on WIX was the goal and was achieved. The process involved embedding the Kepler HTML into WIX and editing the map to appear easy on the eye for the users.
- As a developer, I want an updated UI for the webpage so that it can reflect the latest changes and additions to the overall product. - Tania Perdomo Flores & Revel Etheridge (New/Done) [8pts]
    - Kepler was the original website chosen to model duck locations through heatmapping; in this iteration, Revel was put in charge of integrating Kepler into our R code. The goal was to be able to make a function in R that could receive satellite locations and automatically create a heatmap. This story was not completed since Kepler was scrapped due to its inability to handle the scale of our datasets.
- As a researcher, I want to view simple predicted flight paths without any covariance. - Breanna Woosley (Done) [8pts]
    - This goal is meant to be achieved by a combination of the UI created by Jacob and Tania and the ability to filter out certain variables in Breanna and Kenny's code. The UI will have a checkbox that allows the user to select what they want for the flight path, which would have changed when using the R code to calculate the prediction without the variables. However, due to our issues running the code, this was put on hold as we could not test it.
- As a developer, I want to integrate Deck.gl with OpenStreetMap so that we have a lightweight system that will show our data on a map. - Jacob Sullivan (New/Done) [8pts]
    - With the removal of Kepler.gl, we needed a lighter-weight and more efficient method to visualize our data. With research, the answers were Deck.gl and OpenStreetMap. Jacob was able to create a local host product of an integration of a part of the data from movebank and display it in a heatmap format on top of a map of the globe.

- As a researcher, I want to view simple predicted flight paths without any covariance in python. - Drew Burkhalter (New/Unfinished) [8pts]
    - Originally, we had planned to create an API and a predictive AI model within R, but we had the idea to also try this out in python as well so that we could compare the two and decide which one would fit better for our interest along with the project. So, I got the data from move bank and coded up a map into python to output an interactive html map. Due to some unforeseen issues with a lack of knowledge on my end I was unable to produce a complete predictive algorithm for the flight paths
- As the client, I want to see North America so that the map focuses on the ducks that are tracked within Movebank. - Jacob Sullivan (Done/Dropped) [5pts]
    - Originally, the map included a much wider area showing most of the Western Hemisphere. However, after a meeting with our client, he stated he wants a map showing explicitly the U.S.A and Canada, causing this story to be changed to its current version.
- As a user, I want to be able to see the Mississippi Flyway on the map so that I can easily distinguish where the flyway is. - Tania Perdomo Flores (Done/Dropped) [8pts]
    - This story's purpose was originally to provide clarity for the users about where exactly we were expecting the ducks to fly. However, in the same client meeting about our map size, the client explained how this would be unnecessary. The reasons given are that the users do not need to know of the flyway's existence because their migratory path should be clear from the heat map, and that the map should be simple such as his other suggestion that only North America should be shown.
- As a developer, I want to integrate Kepler with R so that I can export R data into Kepler.gl to allow us to use the visual features of Kepler.gl. - Revel Etheridge (Done/Dropped) [8pts]
    - Our prediction algorithm was originally planned to be written in R, and so we wanted a function within our algorithm that could receive locations (whether historical, present, or predicted) and create a heatmap automatically in Kepler that could be uploaded to the website. Due to Kepler being scrapped (cannot handle the magnitude of data), this integration was dropped.

Plan For Next Iteration:

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Plans for iteration 3 involve improving the skeleton of the app created in the second iteration. For example, now that the website is created and displays properly, we aim to allow the user to interact with it. We plan to create a user interface that will allow the user to interact with the map. A feature that is included is filtering the data so that the user can choose specific species of ducks and see their flight patterns. Iteration 3 will also be used to correct changes made in iteration 2 based on new client input and testing. As we transition into iteration 3, Kepler will be replaced by Deck.gl and OpenStreetMap as they are options that will be lighter weight for the overall project. This change was for the purpose of having a lightweight and efficient solution, as our initial testing with Kepler.gl revealed performance slowdowns even with a small dataset. By adding these open-source alternatives, we aim to enhance our system's responsiveness and

accelerate our progress once the integration is complete.

Another aspect we hope to improve is the processing of data by using the HPC (high processing computer). This will allow us to use larger amounts of data, particularly pulling more accurate data about weather from the API and the data provided by the client. In the original design phase of this iteration, we planned on further refining our probability. Due to our problems processing the data, we do not know how accurate our processing is, so while we still plan to improve the process, we do not know what stage of this process we will complete at this iteration. One final roadblock we faced was the destruction of the HPC at Tennessee Tech due to a fire alarm malfunction. This happened in the final week of Iteration 2, so at the time of writing, we are not sure how quickly this will be fixed and are tentatively looking into new options.

Burnup Chart:

Author: Jacob Sullivan

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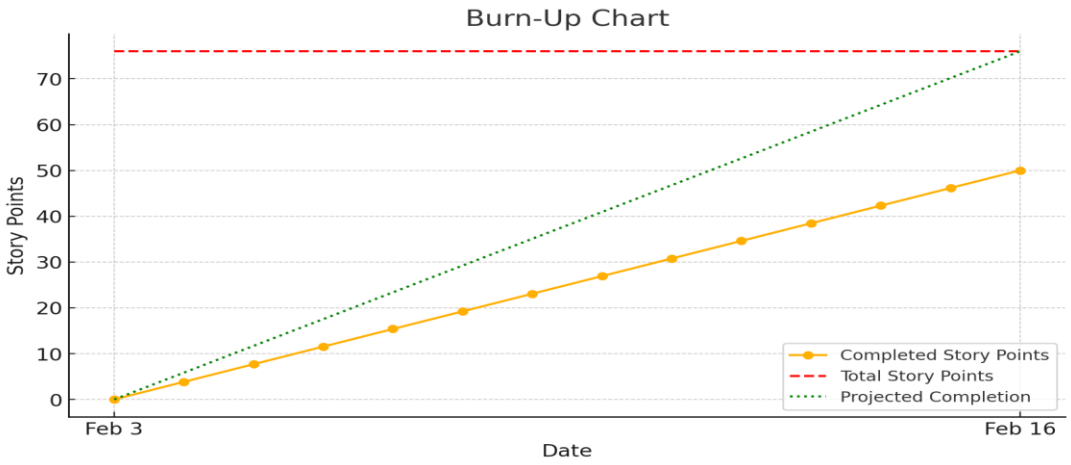

As the burnup chart shows, we fell a little short of where we wanted to be at the end of this iteration. With a projected 76 story points in total, we were only able to complete 50. Leaving us with 26 story points, 18 of the story points are because of software limitations and customer changes. The software limitations include creating a map of the U.S. and Canada and the other limitation was the story involving Kepler.gl, which was due to the unforeseen large amount of data we are needing to manipulate. We had to switch the application to a lighter weight system based around Deck.gl and OpenStreetMap. The customer change of the 18 story points was the implementation of an overlay of the flyways on top of the map, which the customer expressed his thoughts and did not want that feature, so it had to be dropped. The last 8 story points were for the creation of the predictive algorithm with Python using a small set of the waterfowl data. Due to a learning curve in Python and manipulating data within the code, the story was not completed. This will create a minor setback, but we have looked at ways to create the space the team needs to get back on track with the projected velocity for the next iteration.

Retrospective Summary:

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What Has Gone Well?

1. **Website construction**
    a. The team has made significant progress in constructing the website to meet the client's specifications. Using Wix, the site was designed to be flexible and easily customizable, ensuring seamless integration with our code to accurately display migration predictions.
2. **Split of workload**
    a. This iteration required more individual task assignments, enabling team members to focus on specific areas. The team split into smaller groups and communicated effectively, ensuring that all deliverables were compatible and cohesive.
3. **Presentable products**
    a. Due to the planning in the previous iteration, we had a clear structure for what needed to be presented to the client. Both the website and the initial data generation processes were well-received and understood by the client.

What Could Be Improved?

1. **Implementation of Spikes**
    a. Although we spent an iteration familiarizing ourselves with new tools, many team members were using them for the first time. This led to frequent implementation errors, which, while expected, caused frustration, and slowed progress. More practice and guided learning could improve efficiency in future iterations.
2. **Kepler.gl**
    a. The team spent considerable time testing Kepler for mapping integration, with multiple members working to implement it alongside Wix. However, after assessing its compatibility, it was determined that Kepler would not be necessary for the final implementation. While the process provided valuable insights, a significant portion of the work ended up being unnecessary. The chosen solution is Deck.gl with a map API of OpenStreetMap.
3. **R Programming and Machine Learning Implementation**
    a. Work was done to pull weather data and incorporate it into the migration prediction model. While historical and real-time weather data were successfully retrieved, the dataset was too large to process efficiently with the available computational resources.
    b. Work began on writing the LSTM prediction model code, which will be used to predict migration paths based on historical trends. However, the computational requirements for training the model are high, slowing implementation progress. To address this, we are waiting for access to a high-performance computing (HPC) system.

What Questions Do You Have About the Project or Process?

1. **Machine Learning Algorithm Selection**

a. Which machine learning algorithm will best handle our dataset's size and complexity?
b. How can we improve the accuracy of the selected model while managing resource constraints?

What Action Items Need to Be Addressed?

1. **Gain HPC Access**
   a. Secure access to high-performance computing resources to process large-scale machine learning models and datasets.
2. **Confirm Machine Learning Code and Model Selection**
   a. Finalize and validate the LSTM prediction model and confirm its suitability for migration forecasting.
3. **Deck.gl Learning and Implementation**
   a. Begin learning and implementing Deck.gl as the new mapping solution to replace Kepler for visualizing migration paths.

Team Temperature:

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Spider chart along with a description and summary of our team's temperature.

Summary:

After the second iteration of this project, our spider diagram reflects strong performance across most categories. *Team Communication, Workload,* and *Stakeholder Engagement* continue to score well, highlighting our ability to keep open lines of communication, manage responsibilities effectively, and maintain strong relationships with the key stakeholder. Our internal communication remains clear and structured, ensuring that team members have a solid understanding of project goals. Additionally, the

client's proactive engagement—through weekly meetings—has played a significant role in refining project features and keeping user stories aligned.

However, *Project Progress* and *Team Collaboration* scored lower, indicating key areas for improvement. The delay in *Project Progress* was largely due to the need to reassess and adjust certain tasks after extensive research revealed that some aspects were not feasible or required a completely different toolset. This necessary pivot caused setbacks as we adapted to new methodologies and restructured parts of our workflow. While these changes were crucial for long-term project success, they momentarily slowed our momentum. *Team Collaboration* challenges arose from an uneven workload, leading to some discouragement. The added strain on active members affected morale and productivity, highlighting the need for better balance.

Moving forward, our primary focus will be on enhancing task accountability, refining collaboration workflows, and ensuring a more balanced workload distribution. By implementing clearer task ownership, improving cross-functional teamwork, and setting more structured progress checkpoints, we aim to address these gaps while maintaining our strengths in communication and stakeholder engagement.

Showcase:

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At the end of this iteration, our team prepared a showcase of the effort completed. The showcase demonstrates the specific user stories completed during the iteration.

https://youtu.be/K5QJSR9aMPI

Appendix:

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- Kanban Board and GitHub
  - https://github.com/users/JakeSul1023/projects/1/views/1 (Kanban Board GitHub)
  - https://github.com/JakeSul1023/Team-7_Waterfowl (Repository GitHub)
  - https://github.com/JakeSul1023/DuckData-WebApp (Web-Page Repo)