# Stakeholder Sentiment Analysis

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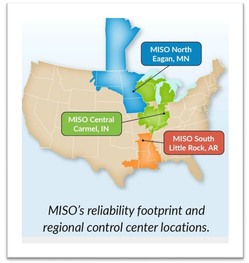
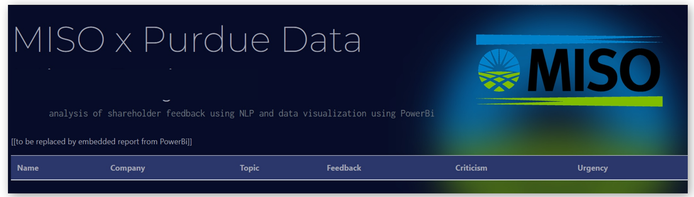
## INTRODUCTION

Midcontinent Independent System Operator (MISO) manages the flow of high-voltage electricity across 15 U.S. states and the Canadian Province of Manitoba. MISO's efforts in facilitating grid operations and maintenance ensure electricity delivery in an efficient, affordable, and sustainable manner.

MISO frequently encounters challenges in managing feedback from stakeholders, due to the sheer volume of it and detail included within. By harnessing the power of natural language processing (NLP), we analyzed 2,954 articles of feedback, enhancing MISO's ability to integrate stakeholder input into their decision-making processes. Our solution involves an interactive dashboard designed to visualize and summarize key insights from the data. The dashboard was developed to augment user-friendliness by allowing employees to easily see various trends within stakeholder feedback and other relationships.




*MISO's reliability footprint and regional control center locations.*




| Text Strings with html tags | Cleaned Results |
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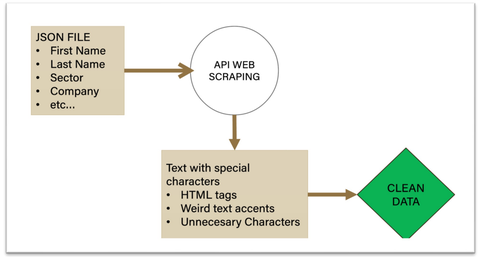
**Figure 1.1**
Web Scraping and Data Preprocessing



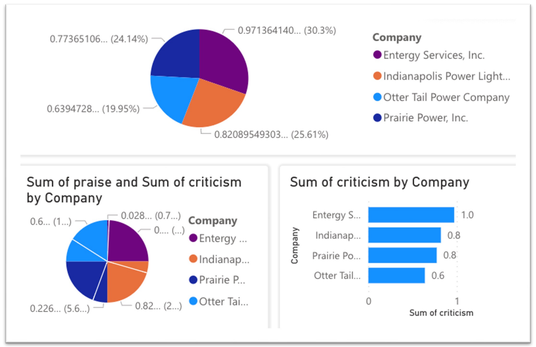




**Figure 2.1**
Investigating Visuals

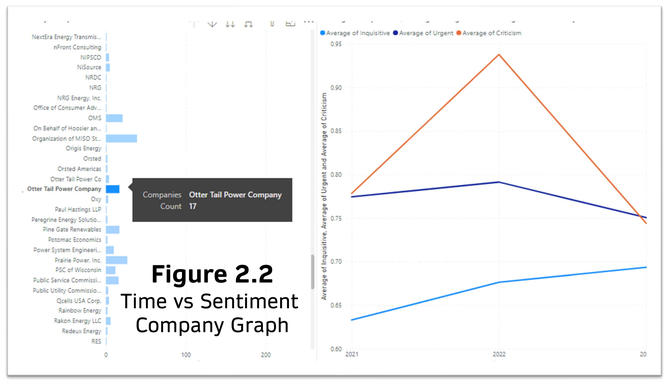
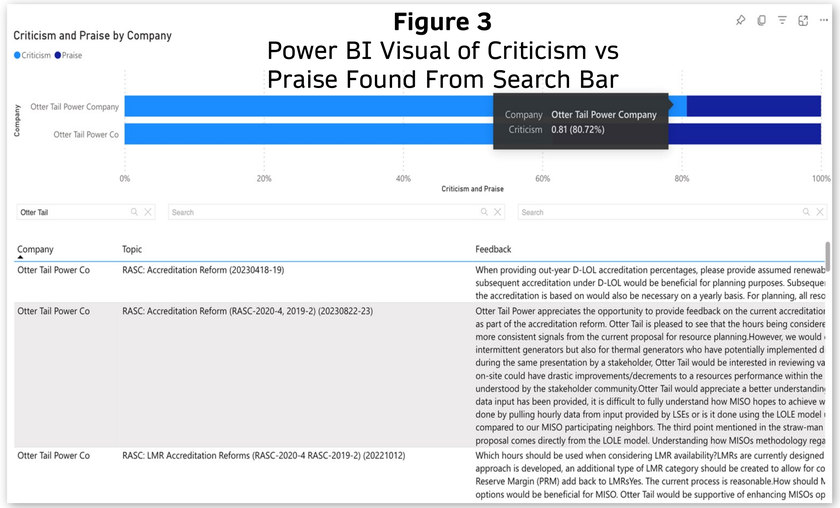



**Figure 2.2**
Time vs Sentiment Company Graph

## WEBSITE DEVELOPMENT

- Built using Flask and hosted on Azure
- Features the Power BI search bar and a MISO-themed background
- When a user enters a phrase in the search bar, the website will present a variety of visuals in the form of graphs related to the inputted text

**Figure 3**
Power BI Visual of Criticism vs Praise Found From Search Bar




## RESEARCH PROCESS AND METHODOLOGY

**Research**:

- Collected stakeholder feedback regarding MISO's energy grid off their public website, via web scraping and storing it in JSON format
- Preprocessed and cleaned data using Beautiful Soup library
- Used pre-trained sentiment analysis models, such as NLTK and spaCy, to classify feedback based on emotional sentiment

**Challenges:**

- The initial NLP models struggled with stakeholder feedback due to the complexities associated with professional writing, which led to an excess of neutral categorizations, thus hindering differentiation between positive, negative, urgent, and inquisitive statements

**Solution:**

- The Zero-Shot Classification model was most effective in analyzing emotional sentiment behind the feedback
- The classifiers we provided the model to follow were criticism, praise, urgent, relaxed, inquisitive, and commanding (no option for neutral)
- Provided much more clarity into stakeholder feedback regardless of the professional tone of the message

**Figure 1.2**
Hugging Face Emotional Sentiment (for all feedback)

Using Hugging Face emotional analysis model:

```
anger: 47
disgust: 3
fear: 95
joy: 479
neutral: 1937
sadness: 20
surprise: 3
```

75.0% Neutral Feedback when all of the Stakeholder Feedback was analyzed

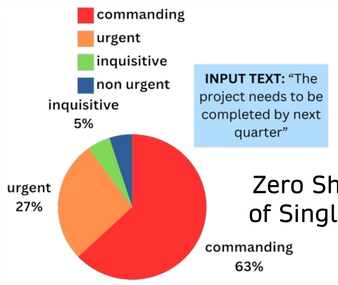



**Figure 1.3**
Zero Shot Analysis of Single Feedback

## RESULTS

- The Zero-Shot model was extensively tested with various feedback types and sentiment and the output was processed and stored in a CSV file
- Power BI was utilized to visualize trends within the model feedback
- A search bar was added, allowing users to access any visual based on their keyword input
- These visuals can aid greatly in identifying areas of improvement related to the energy grid

## FUTURE GOALS

- Create additional categories within the Zero-Shot model to improve accuracy of sentiment analysis
- Create a new feedback form that updates Power BI visuals in real time
- Make the website publicly available on the web
- Develop a timeline that combines sentiment with utility repairs, innovations to correspond with sentiment feedback forms

## ACKNOWLEDGEMENTS

Special thanks to our Corporate Partner mentors, Nate and Haleigh, and our Teaching Assistants, Jenna and Michael, for their guidance and support throughout this project.