VAST Challenge 2021 Mini-Challenge 2

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INTRODUCTION

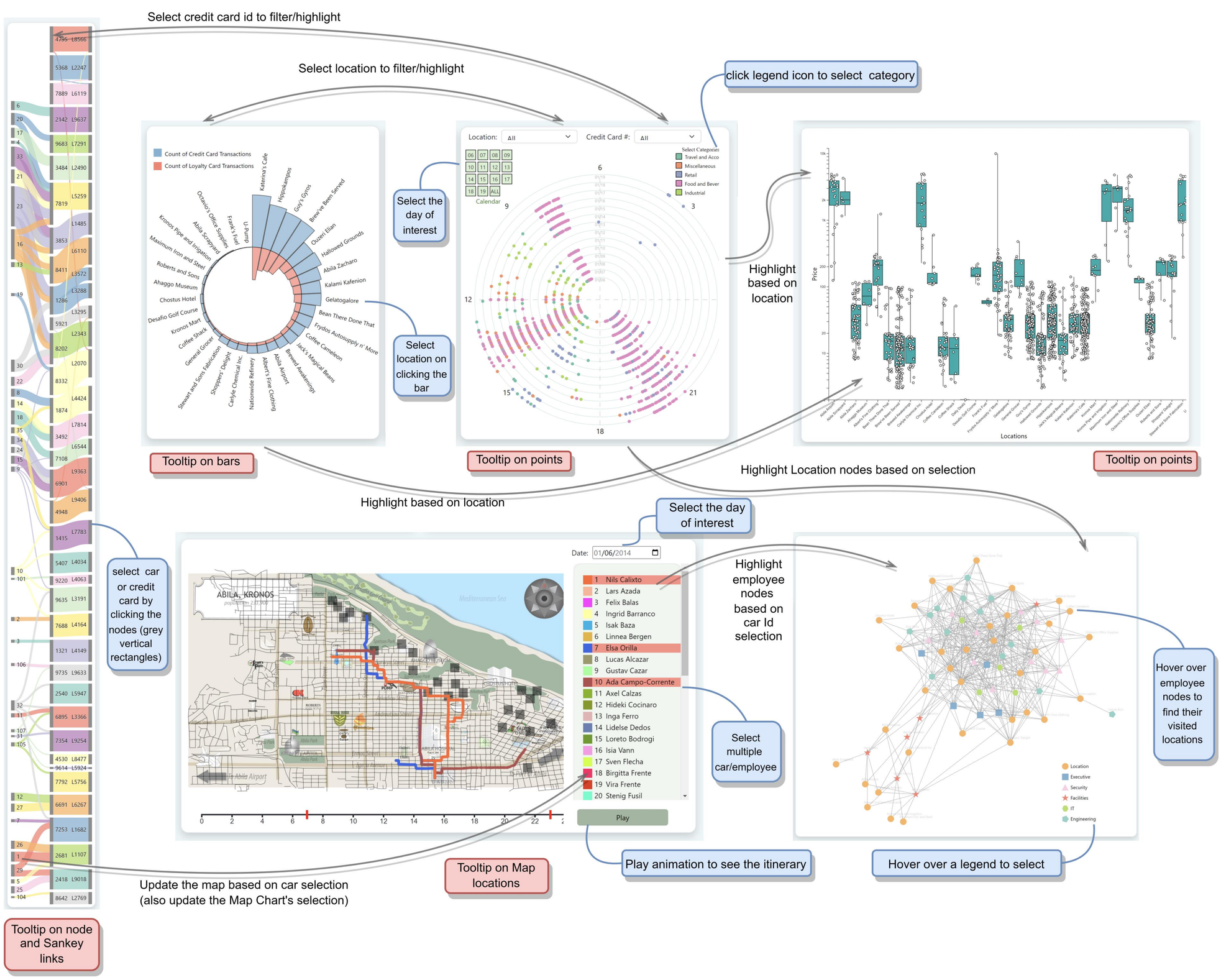
- This project aims to leverage data visualization techniques to aid in the investigation related to the disappearance of employees of a natural gas production company.
- The data provided includes GPS tracking data, credit card transactions, and loyalty card usage data.
- Through visualizations, we aim to answer questions related to anomalies and suspicious behaviors, identify the owners of each credit card and loyalty card, and potential informal or unofficial relationships among GAStech employees.
- Data visualization techniques provide a way to understand the data and provide direction for the analysis. By leveraging these techniques, we can aid the investigators and law enforcement officials in their investigation.

SYSTEM DESCRIPTION

- The most popular locations are identified using credit and loyalty card data. Anomalies are observed, such as transactions recorded at unusual hours and discrepancies in transaction recording. Recommendations for corrections include addressing late reporting of transactions and verifying if transactions were recorded for individuals or groups.
- The analysis is expanded to include vehicle data. The movement of selected vehicles throughout the day is observed, revealing common patterns of leaving home early in the morning, stopping for coffee, going to the office, leaving for lunch, and leaving the office in the afternoon.
- Credit card and loyalty card owners are inferred by establishing car-credit-loyalty relationships using GPS data from vehicles for task 3. Uncertainties exist in the method and data, such as the accuracy of GPS data and potential errors in mapping transactions to vehicles.
- Potential informal or unofficial relationships among GASTech personnel are identified through visualizations. Evidence of relationships between employees based on location and timing of activities is observed, indicating potential suspicious activity or relationships.
- Suspicious activity is identified at specific locations based on abnormal behavior of certain employees, such as working after office hours, driving around executive houses in the middle of the night, and following unspecified paths multiple times. These behaviors raise suspicion of potential suspicious activity.

RESULTS

- An anomalous transaction of $10,000 was recorded at Frydos Autosupply n' More on 13th Jan 2014, which is significantly higher than the average transaction cost for that location ($370).
- The analysis of the vehicle data indicates that the drivers leave their homes early in the morning, make a stop for coffee, and then proceed to their offices. Around noon, they leave their offices for lunch and return to the office until around 5pm before leaving for the day.
- Elsa Orilla and Brand Tempesta seem to be having a relationship, since they both do not live in the same house but go to the same location (Chostus Hotel) for lunch, leaving around lunch time, but a few minutes apart. This behavior can be seen on 8th, 10th, 14th and 17th January.



- From the network plot, we can see that all the executives, along with the CEO (and only these employees) have visited the golf course. If we visualize their vehicle data on the map, we can see that this has happened twice, on 12th and 19th January.
- Isande Borrasca and Adra Nubarron also seem to be having a relationship - it often happens that during lunch hours, Adra's vehicle is spotted at a location, whereas Isande's card is used for the transaction.
- Nils Calixto often works after office hours and ends up leaving the office at a relatively later time - this can be observed from 6th to 14th January, except for 12th January which is a Sunday.
- Minke Mies, Hennie Osvaldo, Isia Vann, Loreto Bodrogi, some of the security employees, are the only ones that are found driving in the middle of the night around the houses of executive employees. It can be seen that nobody else is driving at that point of time. This behavior can be seen on the same timeline as the previous one (6th to 14th January, except for 12th January).

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