SPACETIME

Josh, Jacob, Gillian, Rajpal, Yussuf

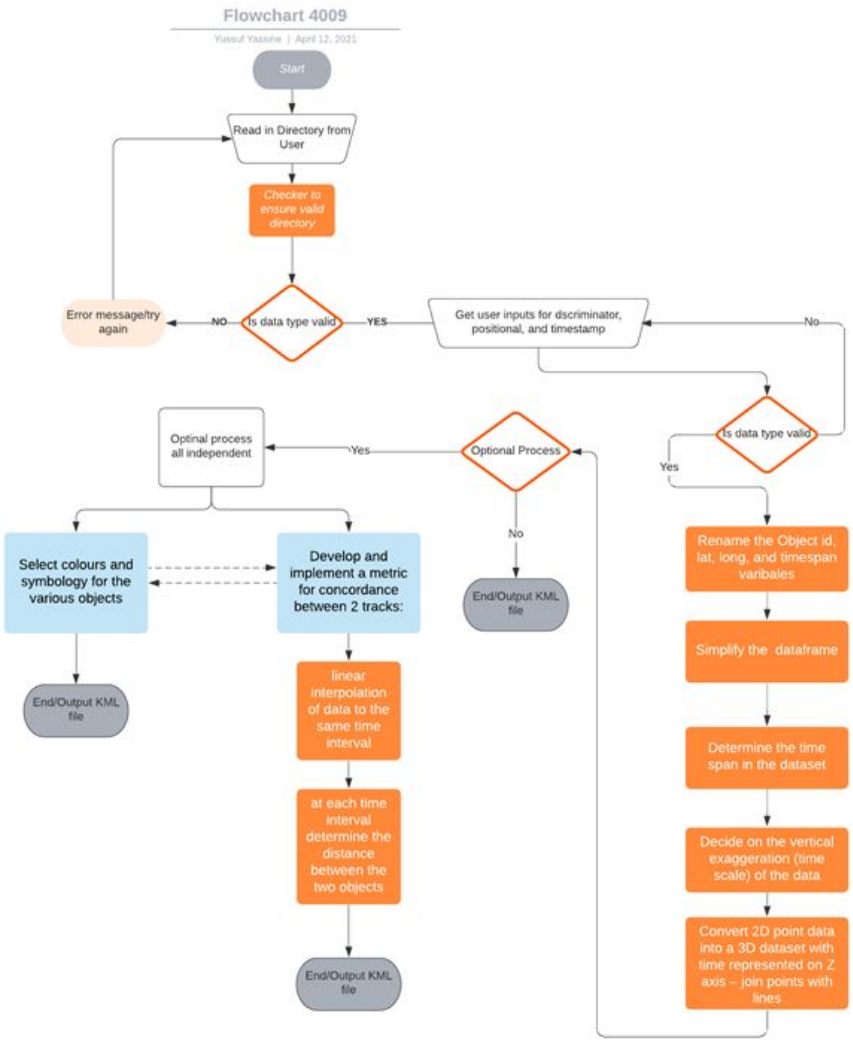
Intro - Organization / Client

- Our project is the “Space-time continuum visualization” project
- Contributors: Gillian, Jacob, Joshua, Rajpal, Yussuf
- Client: Master Corporal Michael Obersnel: Geomatics Technician with Canadian Forces Intelligence Command

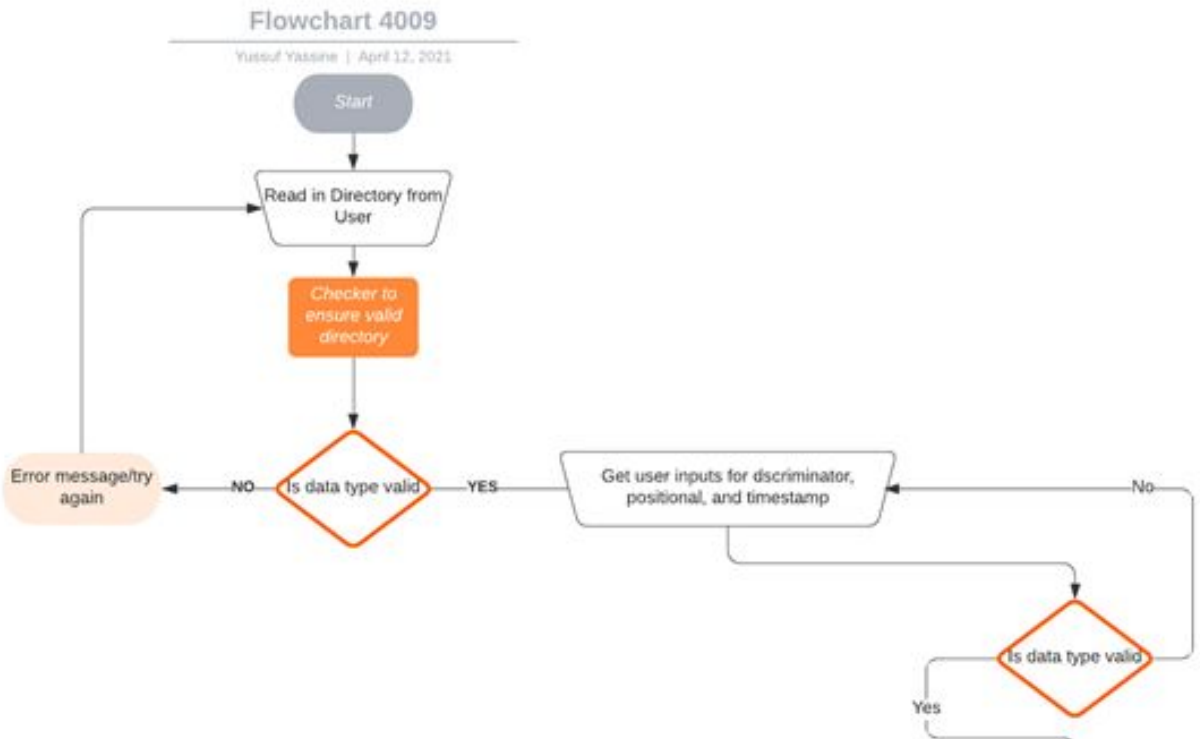
Project Purpose and Scope

- Using x,y positional coordinate, time stamp, and object identifiers data in a .csv format to create a spacetime map
- The spacetime map will represent 3D space of geographic position over time
- The final product will be in a KML format, and can be opened and viewed in different applications such as Google Earth

Workflow


Flowchart 4009
Yussuf Yassine | April 12, 2021
Start
Read in Directory from User
Checker to ensure valid directory
Is data type valid
NO
Error message/try again
YES
Get user inputs for dscriminator, positional, and timestamp
No
Is data type valid
Yes
Optional Process
Yes
Optinal process all independent
No
End/Output KML file
Select colours and symbology for the various objects
End/Output KML file
Develop and implement a metric for concordance between 2 tracks:
linear interpolation of data to the same time interval
at each time interval determine the distance between the two objects
End/Output KML file
Rename the Object id, lat, long, and timespan varibales
Simplify the dataframe
Determine the time span in the dataset
Decide on the vertical exaggeration (time scale) of the data
Convert 2D point data into a 3D dataset with time represented on Z axis – join points with lines

Workflow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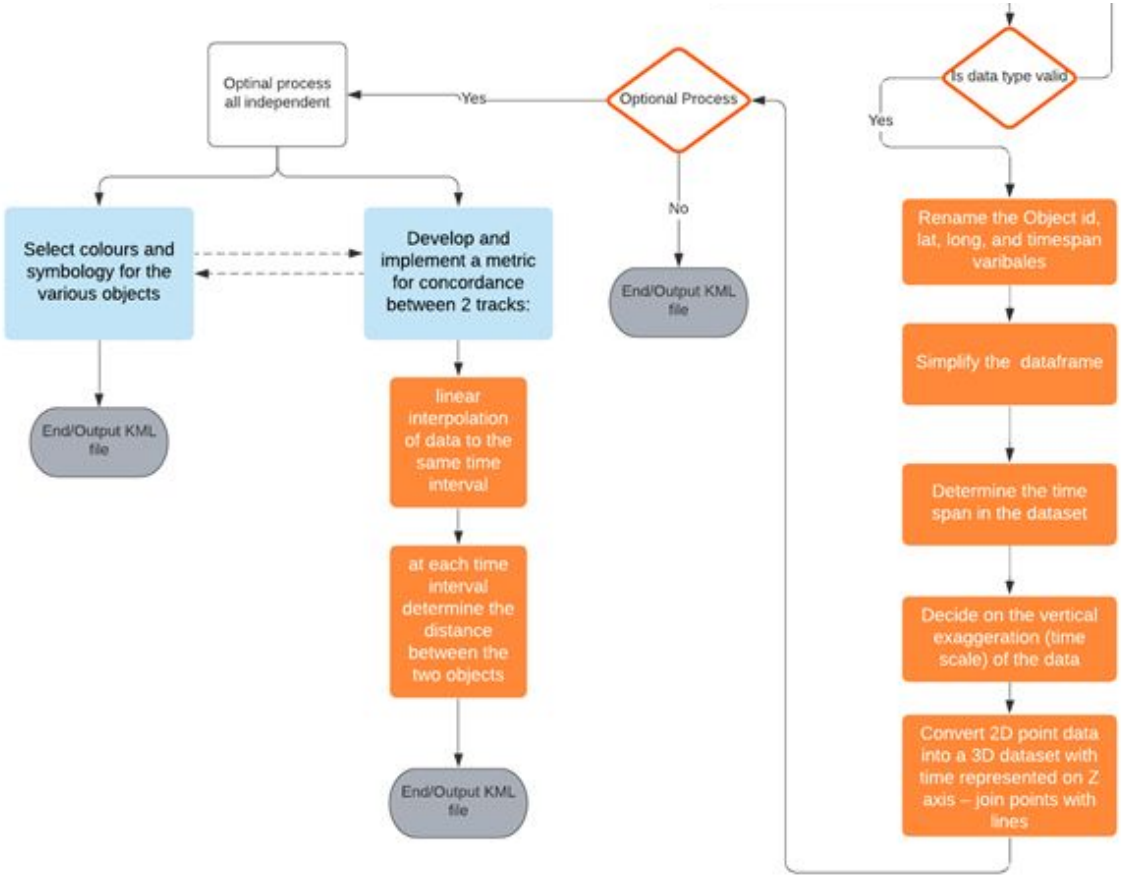
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Documentation

User will be prompted to provide a directory that contains the data file, specify the data file name, and then select the columns that contains objectID, X position, Y position, and timestamp information based on their column index

Data file should be in .csv and is read into the program as a pandas dataframe

Simple Function: Simplifies the dataframe by compressing the number of points for each object

firstLast function: Determines the startDate, endDate, and timespan of the data

Documentation

zScale function: Determines an array of elevation values

PointsLine: Takes in the dataframe and elevation (Z) as parameters to create the projection and 3D shapely LineString that will be exported

KMLExport: exports a kml file using the 3D LineString

Documentation

LOWER PRIORITIES:

Distance between 2 objects – Calculates distance between 2 objects at every shared timestamp and determines the mean, standard deviation, and covariance between them

Distance Matrix: Calculates the distance between every object at a particular point in time

Demo

Challenges/ Limitations/ Future Work

Challenges/ Limitations:

- Flexible Date Format
- Using time to determine Z-Scale
- Ramer-Douglas-Peucker algorithm
- Changing the KML colours
- Distance calculations between objects

Challenges/ Limitations/ Future Work

Future Work:

- Linear interpolation of Time
- Flexibility of coordinate inputs
- A GUI instead of text-based

Conclusion

- Core functions done/high priority elements
- Tackled some low priority functions
- Has good potential to develop further.

Acknowledgment

Thank you Master Corporal Obersnel for giving us the opportunity to work on this project.

Thank you Derek, for the guidance that you have provided for us throughout this entire project.