CISC498 Design Document:
Web-Based Real-time Data Explorer

Group 8
Presenter:
Yucan Li, Yiming Zheng, Wenran Hou, Zhibing Liu, Huilin Xu

Members:

Yucan Li 18yl259@queensu.ca

Yiming Zheng 19yz38@queensu.ca

Wenran Hou 18wh10@queensu.ca

Zhibing Liu 18zl142@queensu.ca

Huilin Xu 18hx16@queensu.ca

Supervisor: Jianbing Ni

Customer: Laura Thomson, Christopher Omelon, Madeline Myers

External Design

Introduction:

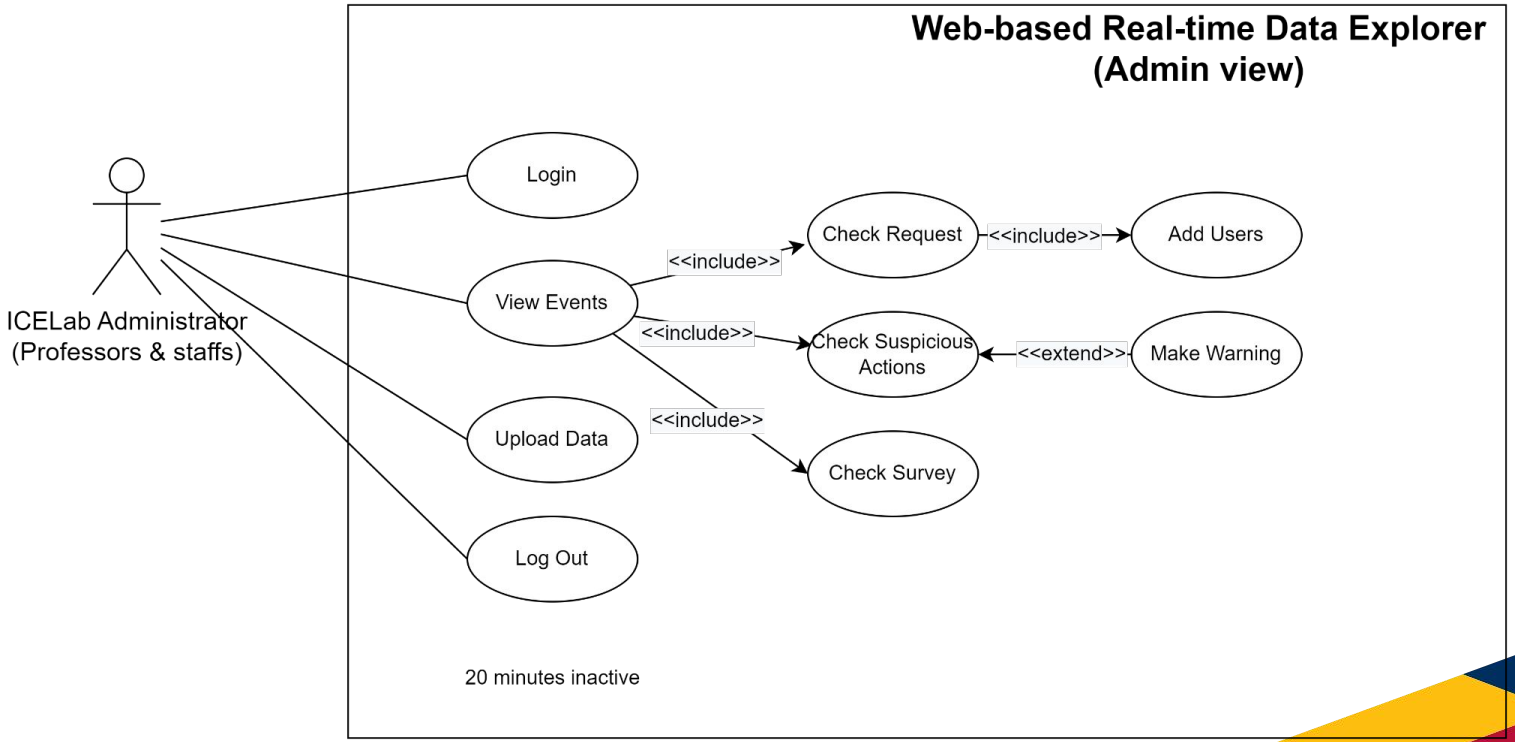
- **Purpose**
  - Facilitate ICELab to organize datasets into a more accessible form
  - Help customer communicate scientific finding effectively and engage people within the community
- **Content Overview**
  - UX design concpet
  - User Flow Diagram
  - Usage Scenarios
  - Integration with existing processes
  - Feedback from customer

User interface design

Figma Website:
https://www.figma.com/file/h6OqYGj28BYTM2SncepR3t/CISC498?node-id=0%3A1&t=g19i4AHY3dVAVXC0-0

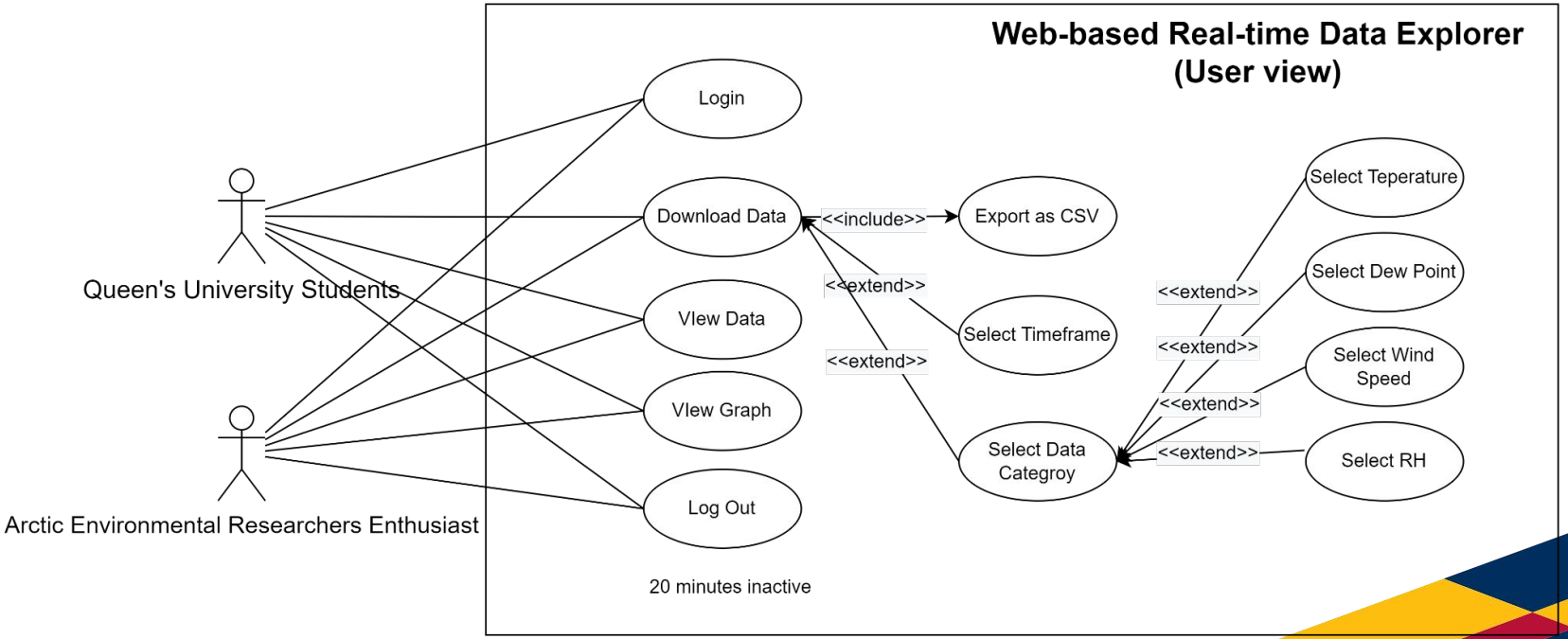
Usage scenarios

- ICELab Administrator (Professors & staffs)



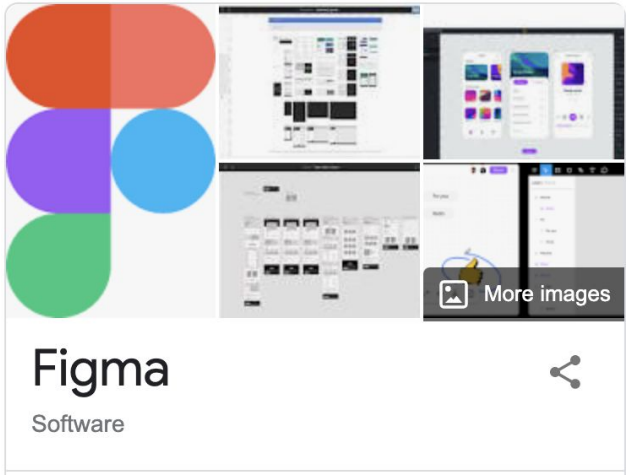
Usage scenarios

- Queen's University Students
- Arctic Environmental Researchers Enthusiast



Prototype

- **Prototype Method**

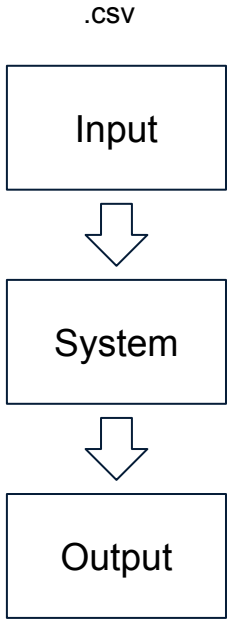


- **Prototype Design Concept**

1. Optimized operation, Pattern avoidance, Consistency
2. Layout is also consistent in terms of color, formatting, and navigation commands
3. Make each button clearly visible and guided

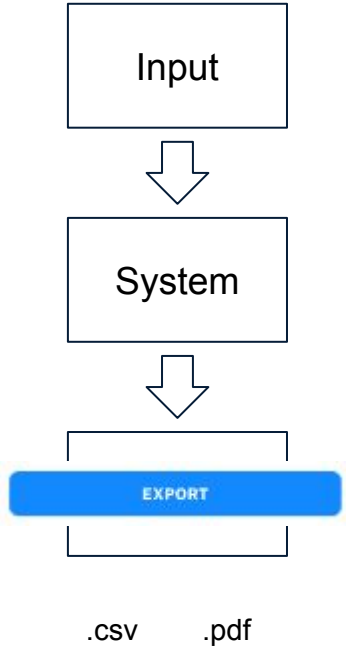
Work products

- Require Input
  - Upload datasets (manual or automatic)
  - Update from Dropbox or Queen's Computer
  - Files in .csv format



Work products

- Require Output
  - Files in .csv and .pdf format
  - Screenshot taken from generated graphs



Integration with existing processes

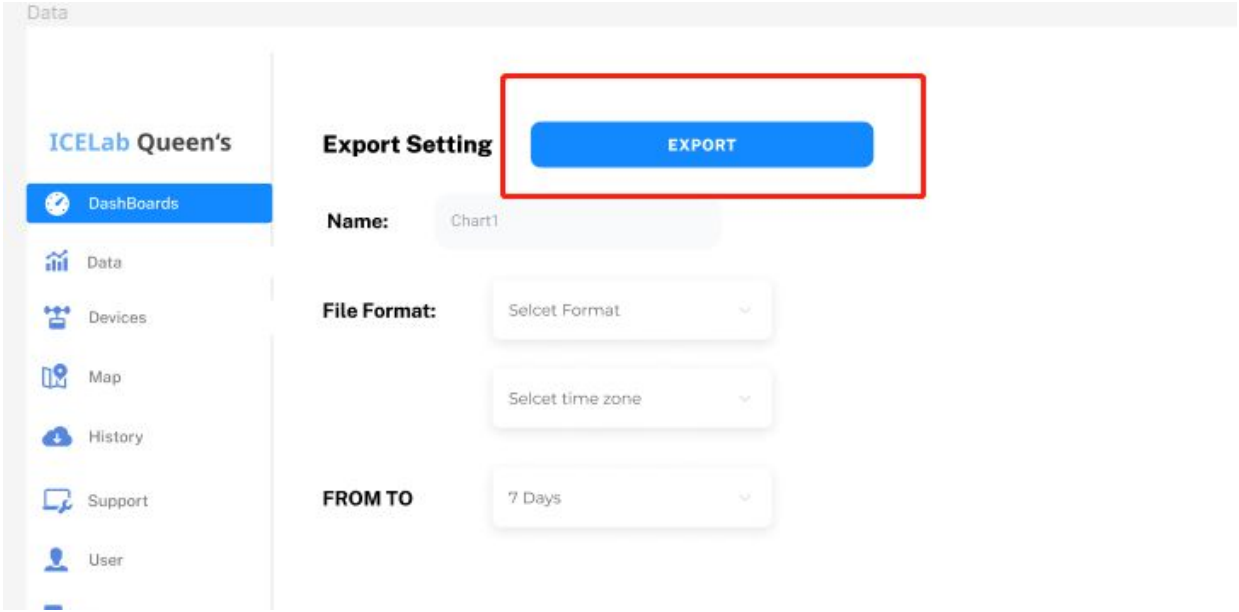
Our Customer

- Before:

- After:

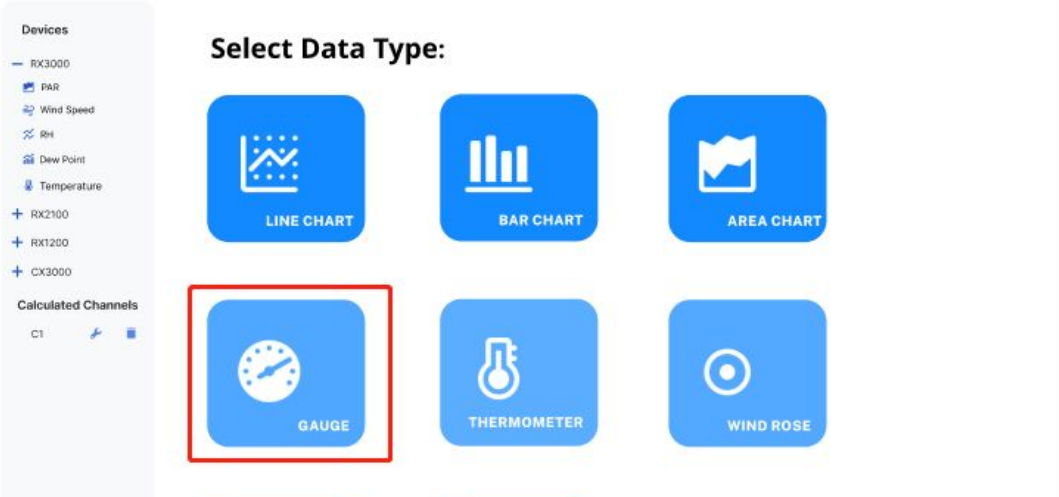
Feedback from customer

- Export Setting Page: customers expect the Export button to be placed at a lower level of the page to match the user's intuition and to make operation easier.



Feedback from customer

- Select Data Type: Users wanted to remove "Gauge" as a data type because it was not a function of the data they were measuring.



Feedback from customer

- Add “Station” category behind each “Device” (a station have several devices)

Feedback from customer

1. Public users should be able to access the Dashboard
2. Making the “Map” first page of the explorer
3. Adding administration page

Internal Design

Programming environment

- **IDE**

  Visual studio code && Intellij
- **Programming language**

  Front-end : javascript, HTML, CSS

  Back-end : python
- **Database system**

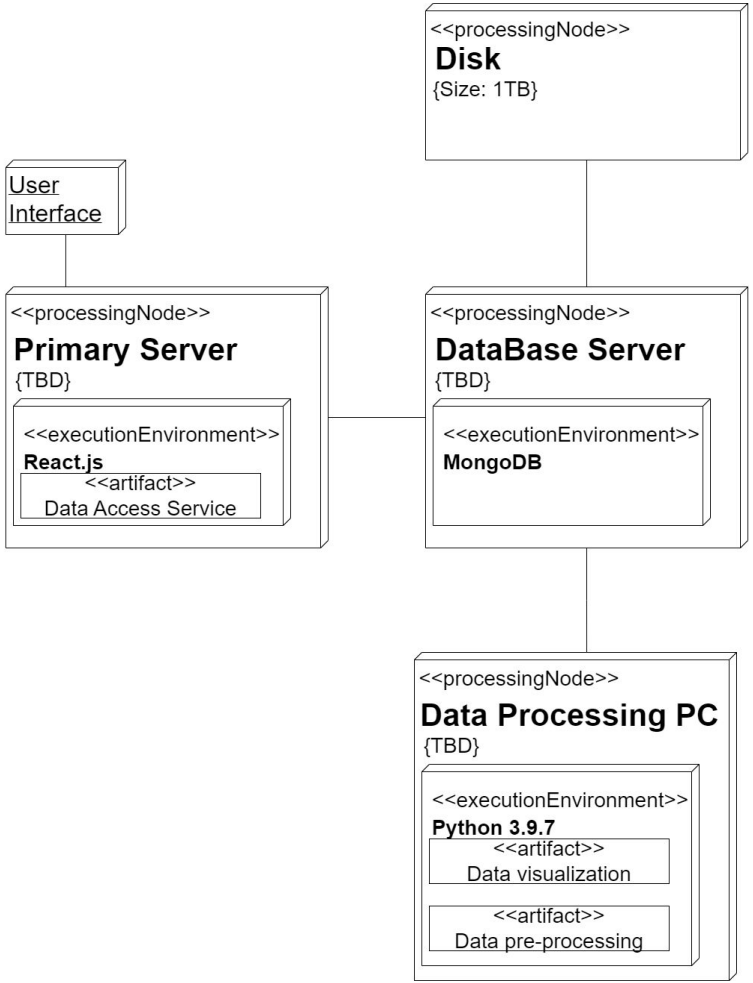
  MongoDB, Mysql
- **Source control system**

  Github, Git
- **UML tool**

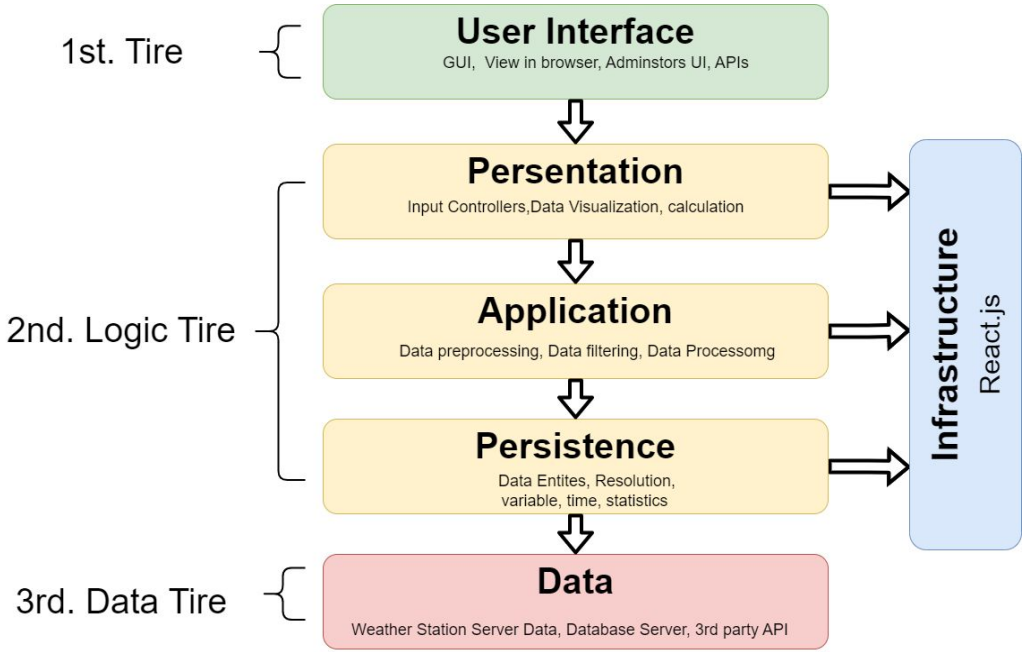
  Draw.io

Software architecture

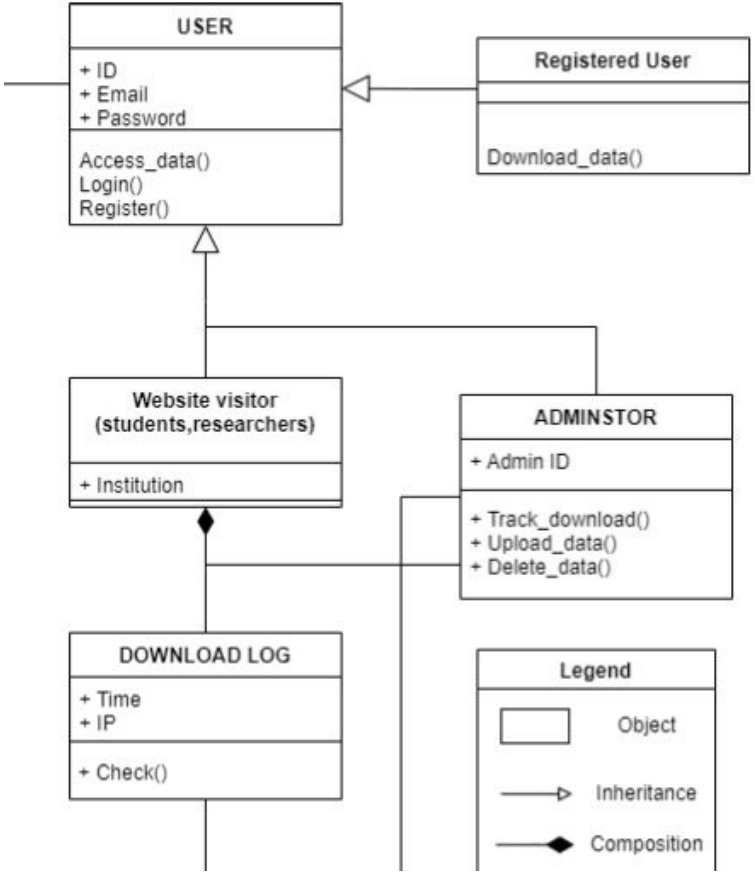
Deployment view

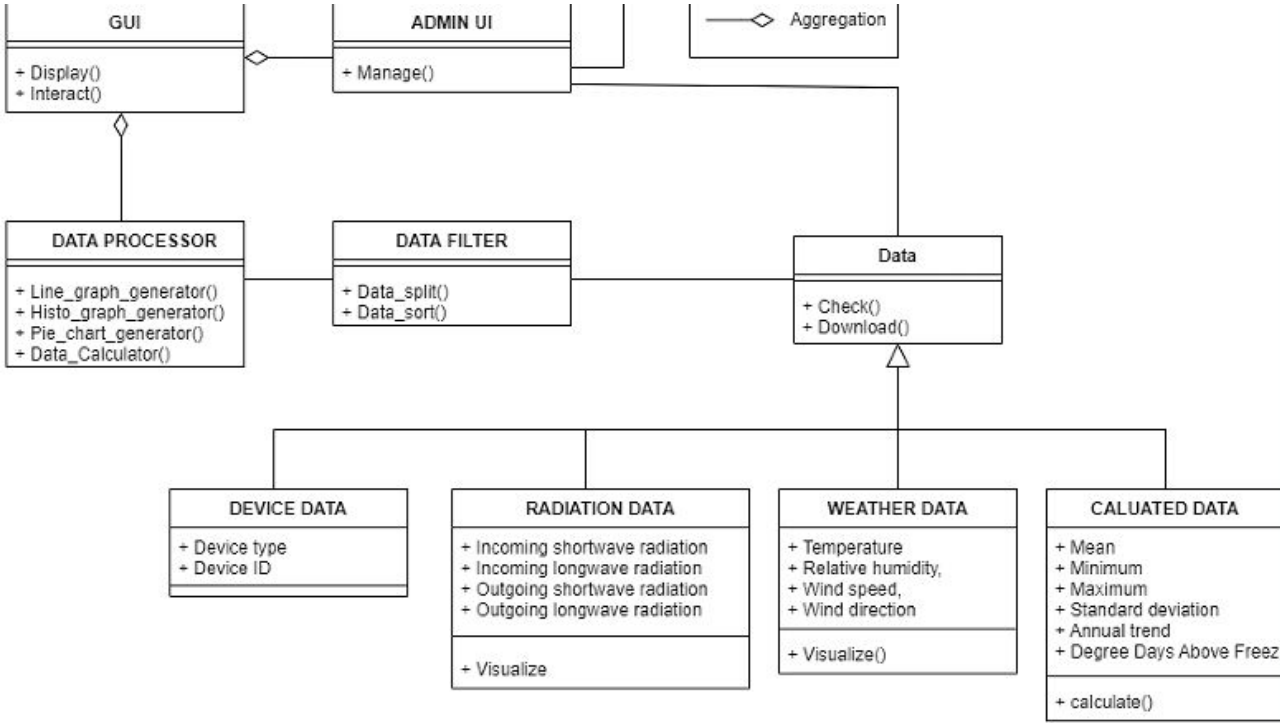


Architecture style



Class diagram




GUI
+ Display()
+ Interact()
ADMIN UI
+ Manage()
Aggregation
DATA PROCESSOR
+ Line_graph_generator()
+ Histo_graph_generator()
+ Pie_chart_generator()
+ Data_Calculator()
DATA FILTER
+ Data_split()
+ Data_sort()
Data
+ Check()
+ Download()
DEVICE DATA
+ Device type
+ Device ID
RADIATION DATA
+ Incoming shortwave radiation
+ Incoming longwave radiation
+ Outgoing shortwave radiation
+ Outgoing longwave radiation
+ Visualize
WEATHER DATA
+ Temperature
+ Relative humidity,
+ Wind speed,
+ Wind direction
+ Visualize()
CALUATED DATA
+ Mean
+ Minimum
+ Maximum
+ Standard deviation
+ Annual trend
+ Degree Days Above Freez
+ calculate()

Interfaces of key components

DataBase:

- **Input:**
  INT-1: weather data
  INT-2: radiation data
  INT-3: account data
  INT-4: download logs
- **Output:**
  OUT-1: data location
- **Pre-condition**
  PRE-1: Enough space for input in the disk.
- **Post-condition**
  POST-1: Data is stored in the given location.
- **Exception**

  Exp-1: Incorrect data type
  Exp-2: Manual Interupt
  Exp-3: Store overtime

Data Filter

- **Input:**
  INT-1: Data location
  INT-2: Time Range
- **Output:**
  OUT-1: Splited Data
- **Pre-condition**
  PRE-1: Data in the location given is valid
  PRE-2: Inputed Time Range is vaild
- **Post-condition**
  POST-1: The output Splitted Data fits the input requirements
  POST-2: The data in the database remains the same
- **Exception**
  EXP-1: Data missing.

Data Visualization

- **Input:**
  INT-1: Data
- **Output:**
  OUT-1: Different kinds of Graphs
- **Pre-condition**
  PRE-1: Input time range is valid
- **Post-condition**
  POST-1: Users successfully receive the graph they request.
- **Exception**
  EXP-1: Website crashed
  EXP-2: Data missing

GUI

- **Input:**
  INT-1: User interactions
  INT-2: Administer command
- **Output:**
  OUT-1: requested data
  OUT-2: result of commands
- **Pre-condition**
  PRE-1: Administer’s ID has been verified for administer command
  PRE-2: Website server is running
  PRE-3: User’s Internet connection is stable
- **Post-condition**
  POST-1: Users successfully receive the service they request.
- **Exception**
  Exp-1: Server under maintenance

Data design

- Combination of input and output files and databases

- Backus–Naur Form

<station>::=<location><time><resolution><variables><statistics>

<location>::=region | latitudeLongitude

<time>::=startEnd

<resolution>::=original | <period> | entireDataset

<period>::=monthly | hourly | daily | weekly | annually | seasonally

<variables>::=temperature | relativeHumidity | windSpeedDirection | <radiation> | distance

<radiation>::=<outgoingRadiation> | <incomingRadiation>

<outgoingRadiation>::=outShortwave | outLongwave

<incomingRadiation>::=inShortwave | inLongwave

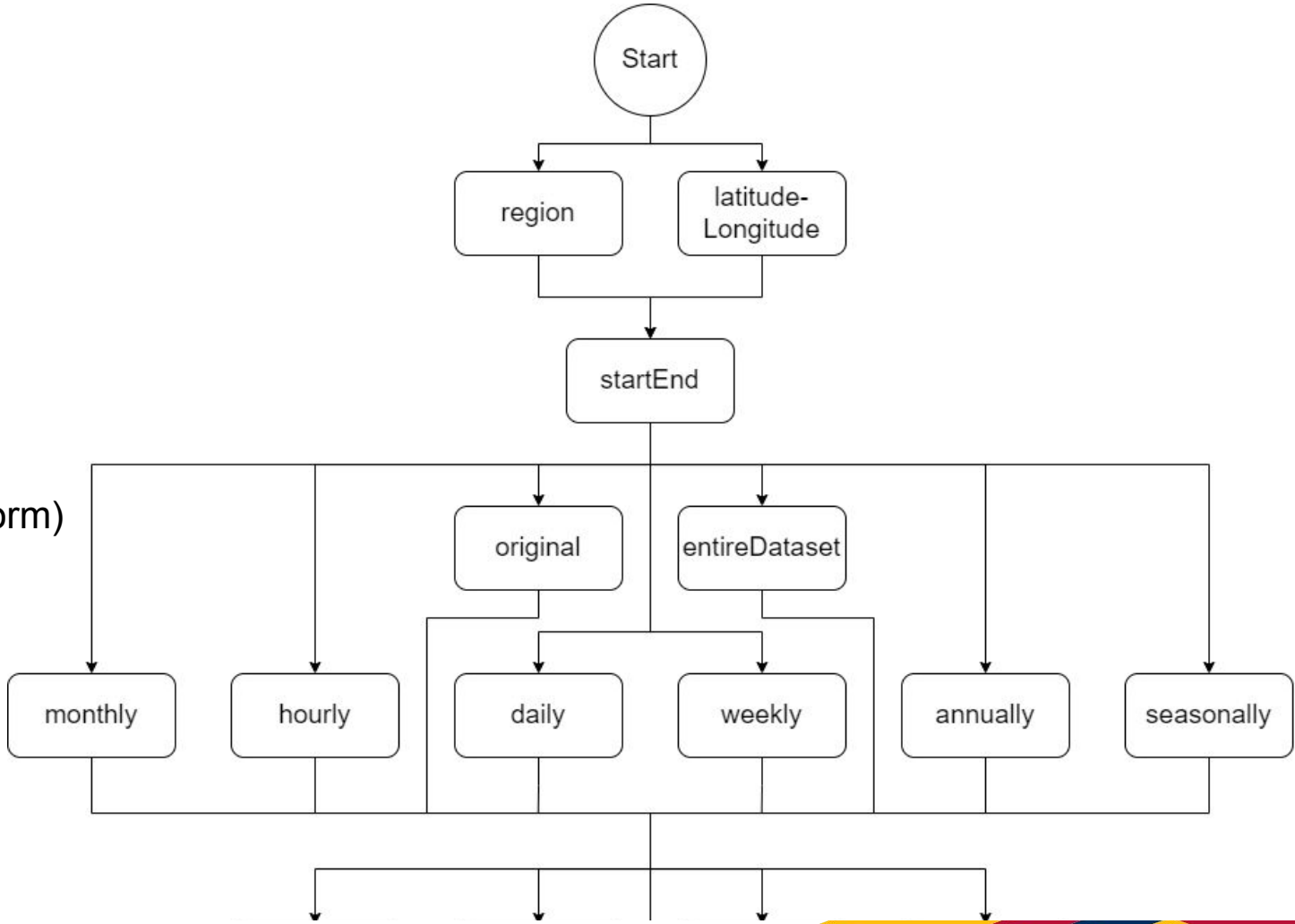
<statistics>::=windFrequency | mean | standardDeviation | <extreme> | annualTrend | degreeDaysAboveFreezing

<extreme>::=minimum | maximum

Data design

- Syntax Diagram

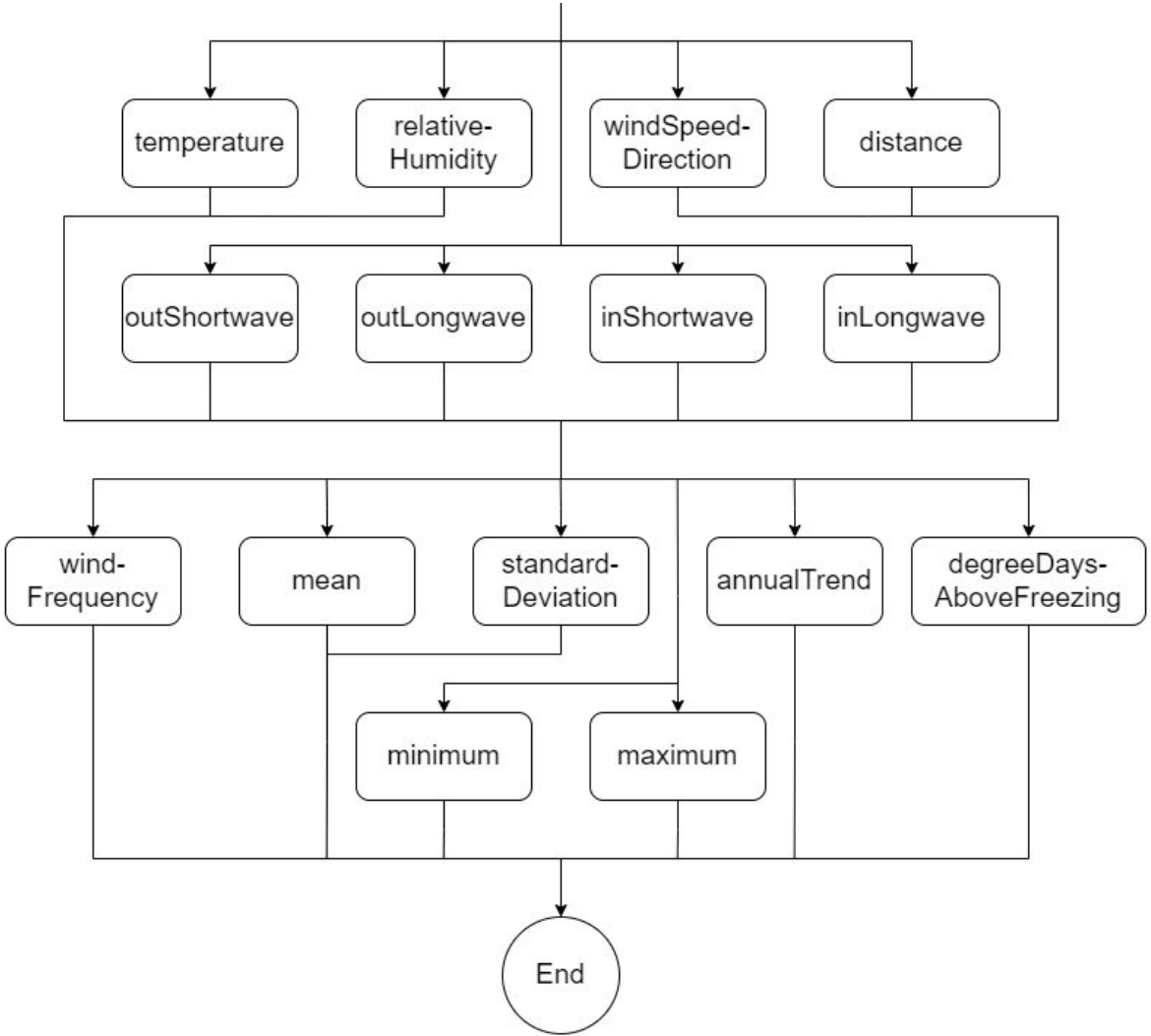
  (Backus–Naur Form)



Data design

- Syntax Diagram

  (Backus–Naur Form)



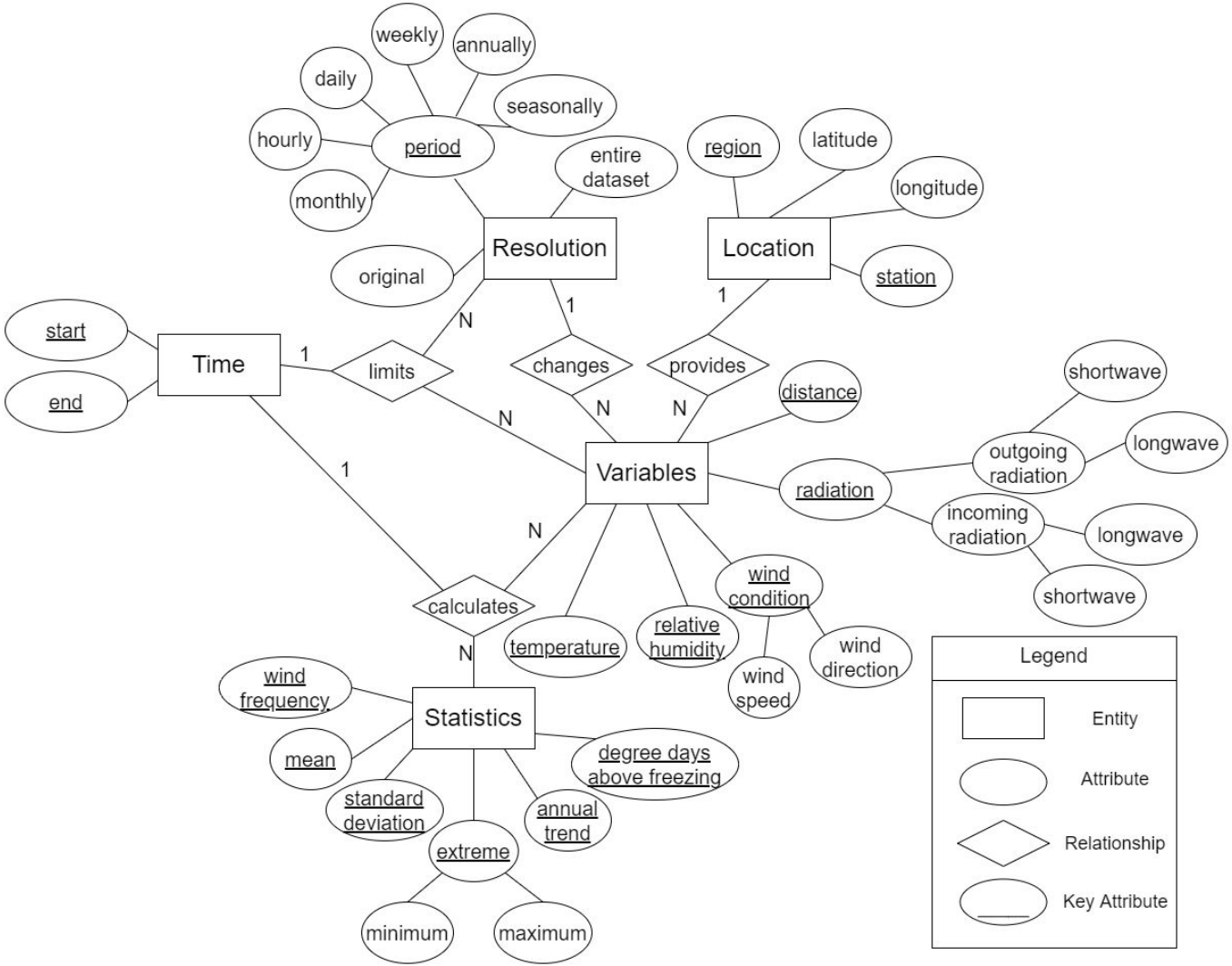
Data design

- Chosen a CSV format instead of an XML format

1. Plain text file
2. Less storage space
3. The data from the station is in CSV format

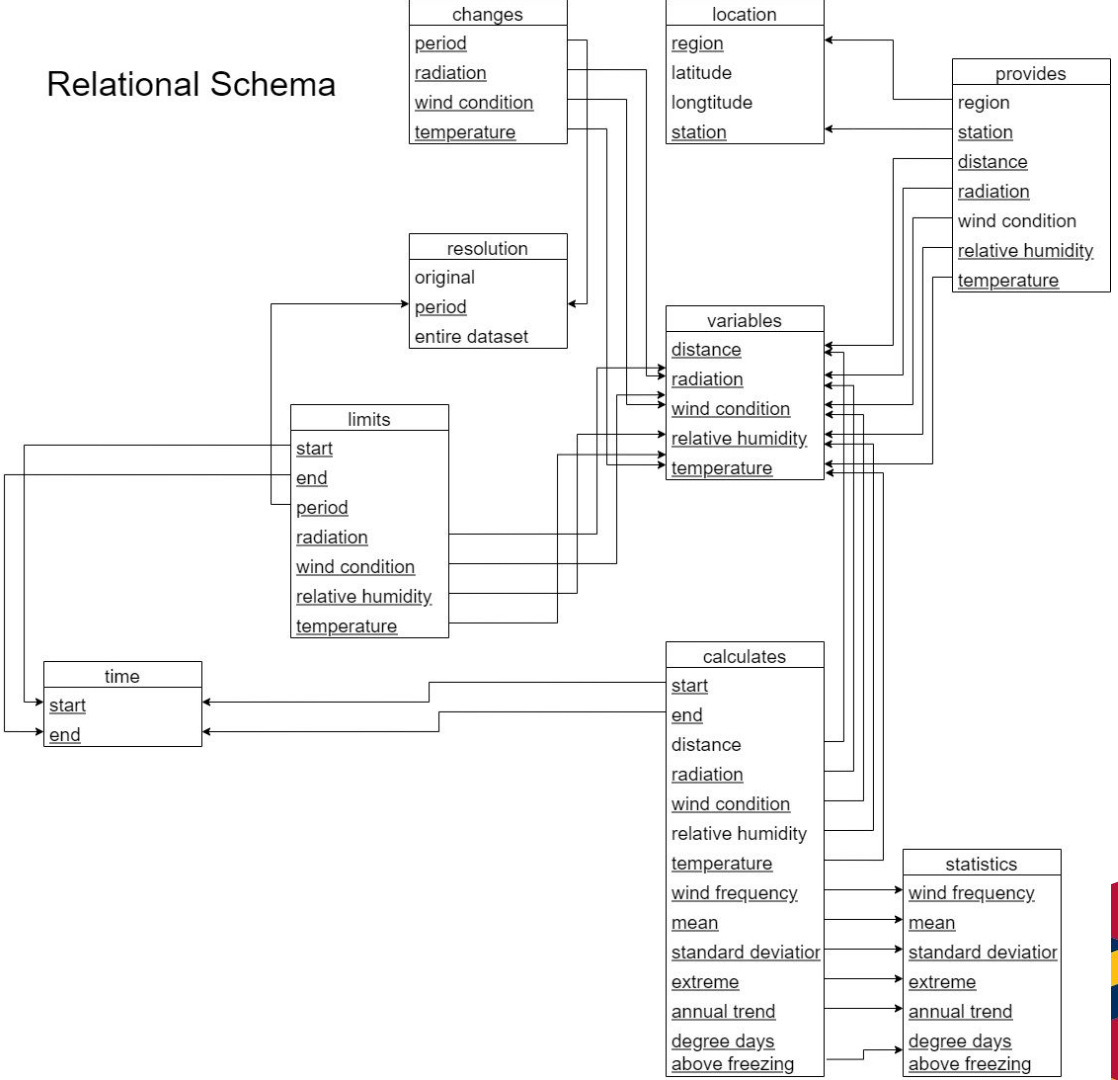
Data design

ER diagram



Data design

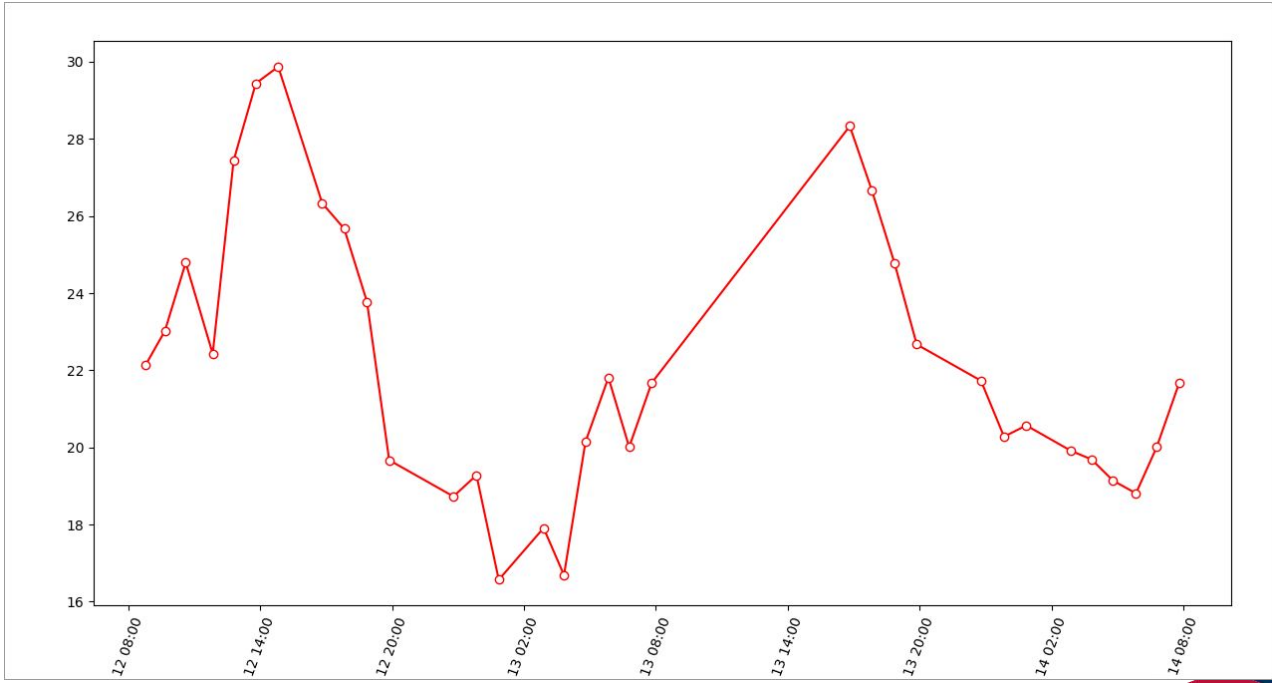
Relational Schema



Algorithms

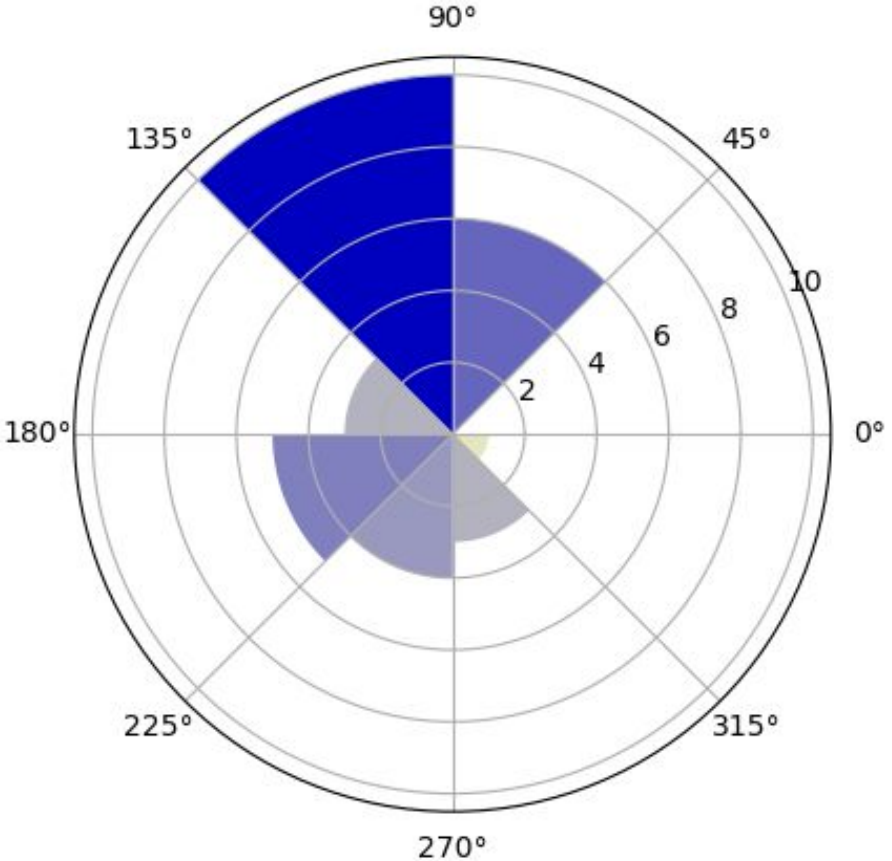
1. Simple data calculation

2. Plotting of line graphs



Algorithms

3. Plot the polar diagram



Notable tradeoffs

- Functionality vs. Memory Size
  - CSV or XML

Notable Risk

- Performance
- security
  - DDOS
  - Injection

Questions?

Thank you!