Report: Candlestick Data Processing System Implementation

Task 1: Compute Candlestick Data

Key Implementation

The CandlestickCalculator class processes temperature data for a specific country and computes candlestick data.

```
std::vector<Candlestick> CandlestickCalculator::computeCandlesticks(
    const std::vector<TemperatureEntry>& entries, const std::string& country);
```

Challenges and Solutions

1. **Reusing the existing CSVReader class**:
   Initially, the goal was to modify the CSVReader class from previous lessons to accommodate this project's requirements. However, this approach proved cumbersome and inefficient. Ultimately, we decided to redesign and create a new CSVReader tailored to this project, which simplified the data parsing process significantly.
2. **Handling large datasets**:
   The dataset contained hourly temperature data spanning multiple years, making performance optimization crucial. By first testing on smaller datasets and optimizing the loop structures, we ensured smooth performance on the full dataset.

Task 2: Text-Based Plot Creation

Key Implementation

The CandlestickPlotter class generates text-based plots:

- | represents Open and Close.
- - represents High and Low.

- o marks the zero-temperature reference point.

```
void CandlestickPlotter::plot(const std::vector<Candlestick>& candlesticks);
```

Challenges and Solutions

1. **Scaling the plot**:
   Different temperature ranges made it difficult to standardize the plot. Setting a fixed range (-10°C to 30°C) with a normalized scale resolved this issue.
2. **Aligning the zero-temperature reference**:
   Including the zero marker (o) ensured a clear reference point in the plot, improving data interpretation.

Task 3: Data Filtering

Key Implementation

The CandlestickFilter class provides two filtering options:

Filter by date range:

```
std::vector<Candlestick> CandlestickFilter::filterByDateRange(
    const std::vector<Candlestick>& candlesticks, const std::string& startDate, const std::string& endDate);
```

Filter by temperature range:

```
std::vector<Candlestick> CandlestickFilter::filterByTemperatureRange(
    const std::vector<Candlestick>& candlesticks, double minTemp, double maxTemp);
```

Challenges and Solutions

1. **Chaining filters**:
   Combining date range and temperature range filters required careful design. This was addressed by ensuring the filters worked sequentially and consistently.
2. **Edge case handling**:
   Cases like overlapping date ranges or extreme temperature values were tested extensively to ensure robustness.

Task 4: Data Prediction

Key Implementation

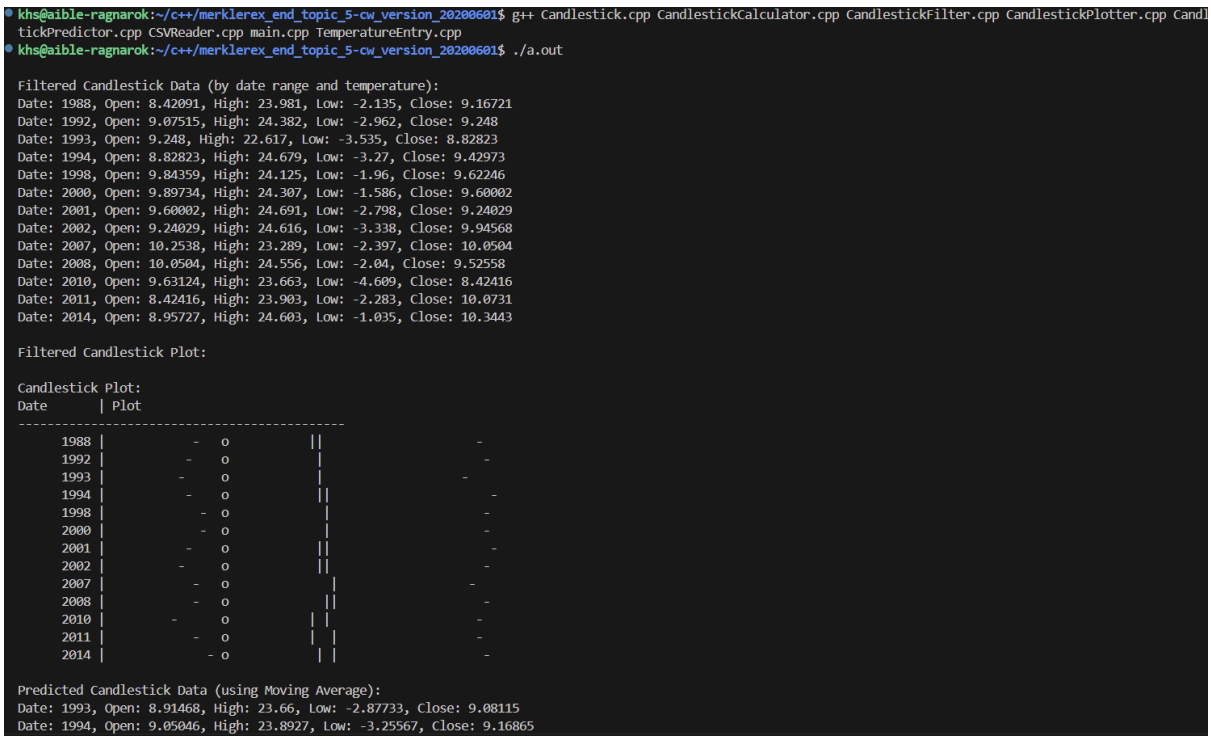
The CandlestickPredictor class generates predictions based on moving averages:

```
std::vector<Candlestick> CandlestickPredictor::predictMovingAverage(
    const std::vector<Candlestick>& candlesticks, int windowSize);
```

Challenges and Solutions

1. **Integration with existing visualization**:
   Ensuring the predicted candlesticks seamlessly aligned with the existing data required maintaining a consistent data structure.
2. **Window size optimization**:
   A large window size overly smoothed the data, while a small window size reduced predictive accuracy. A window size of 3 was chosen for its balance between smoothness and meaningfulness.

Result



```
Predicted Candlestick Data (using Moving Average):
Date: 1993, Open: 8.91468, High: 23.66, Low: -2.87733, Close: 9.08115
Date: 1994, Open: 9.05046, High: 23.8927, Low: -3.25567, Close: 9.16865
Date: 1998, Open: 9.30661, High: 23.807, Low: -2.92167, Close: 9.29347
Date: 2000, Open: 9.52305, High: 24.3703, Low: -2.272, Close: 9.55074
Date: 2001, Open: 9.78031, High: 24.3743, Low: -2.11467, Close: 9.48759
Date: 2002, Open: 9.57922, High: 24.538, Low: -2.574, Close: 9.59533
Date: 2007, Open: 9.69804, High: 24.1987, Low: -2.84433, Close: 9.74546
Date: 2008, Open: 9.84817, High: 24.1537, Low: -2.59167, Close: 9.84055
Date: 2010, Open: 9.97848, High: 23.836, Low: -3.01533, Close: 9.33338
Date: 2011, Open: 9.3686, High: 24.0407, Low: -2.97733, Close: 9.34095
Date: 2014, Open: 9.00422, High: 24.0563, Low: -2.64233, Close: 9.61386

Predicted Candlestick Plot:

Candlestick Plot:
Date       | Plot
-------------------------------------------
      1993 |           -    o            |                    -
      1994 |           -    o            |                    -
      1998 |           -    o            |                    -
      2000 |            -   o            |                     -
      2001 |            -   o            |                     -
      2002 |            -   o            |                     -
      2007 |           -    o            |                     -
      2008 |            -   o            |                     -
      2010 |           -    o            |                    -
      2011 |           -    o            |                     -
      2014 |            -   o           ||                     -
khs@aible-ragnarok:~/c++/merklerex_end_topic_5-cw_version_20200601$
```