

COMPUTER ENGINEERING WORKSHOP

S.E. (CIS) OEL REPORT

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Problem Description

The Integrated Environmental Monitoring System aims to leverage contemporary technologies of computer engineering to retrieve, process, analyze, and report real-time environmental data. The project encompasses various key functionalities including data retrieval from a free API, processing and analysis using C programming concepts, data storage, reporting system development, automation, optimization, and real-time alerts.

Important Features

Data Retrieval:

The system interacts with a free API to retrieve real-time environmental data, such as temperature and humidity. This is achieved through HTTP requests, and the obtained data serves as the foundation for subsequent processing and analysis.

Data Processing & Analysis:

Using C programming concepts, the retrieved data undergoes processing. Algorithms are implemented to analyze environmental data, identifying anomalies or trends. The implementation includes robust error handling to ensure the system's reliability.

Data Storage:

The system efficiently stores both raw and processed environmental data in files. This ensures data integrity and provides a historical record for future reference or analysis.

Reporting System:

A comprehensive reporting system is developed, generating reports based on the analyzed environmental data. The reports are structured, providing insights into environmental trends, anomalies, and noteworthy observations.

Automation & Integration:

Shell scripts are created to automate tasks such as data retrieval, processing, and report generation. These scripts are seamlessly integrated with the C program, enhancing automation and overall system efficiency.

Optimization & Efficiency:

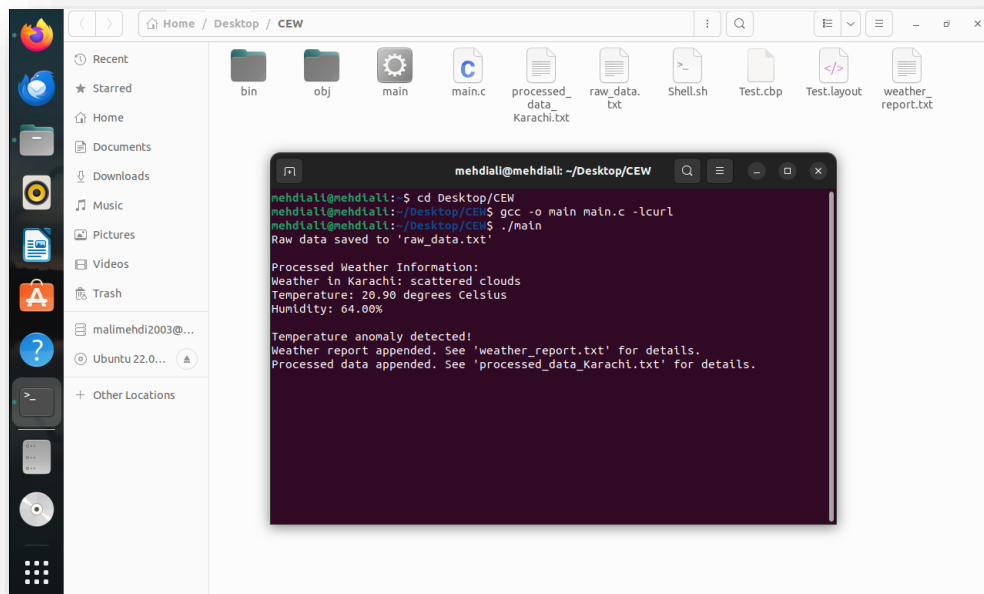
Pointers and dynamic memory allocation are judiciously employed in the C program to optimize data manipulation. This enhances the system's efficiency, ensuring optimal resource utilization.

Real Time Alerts:

Critical environmental readings trigger real-time alerts using Linux system calls. This feature notifies relevant personnel promptly, allowing for timely responses to potential issues.

Runtime Snippets

The code is compiled and run through the terminal which as a result generates the raw and processed data files:

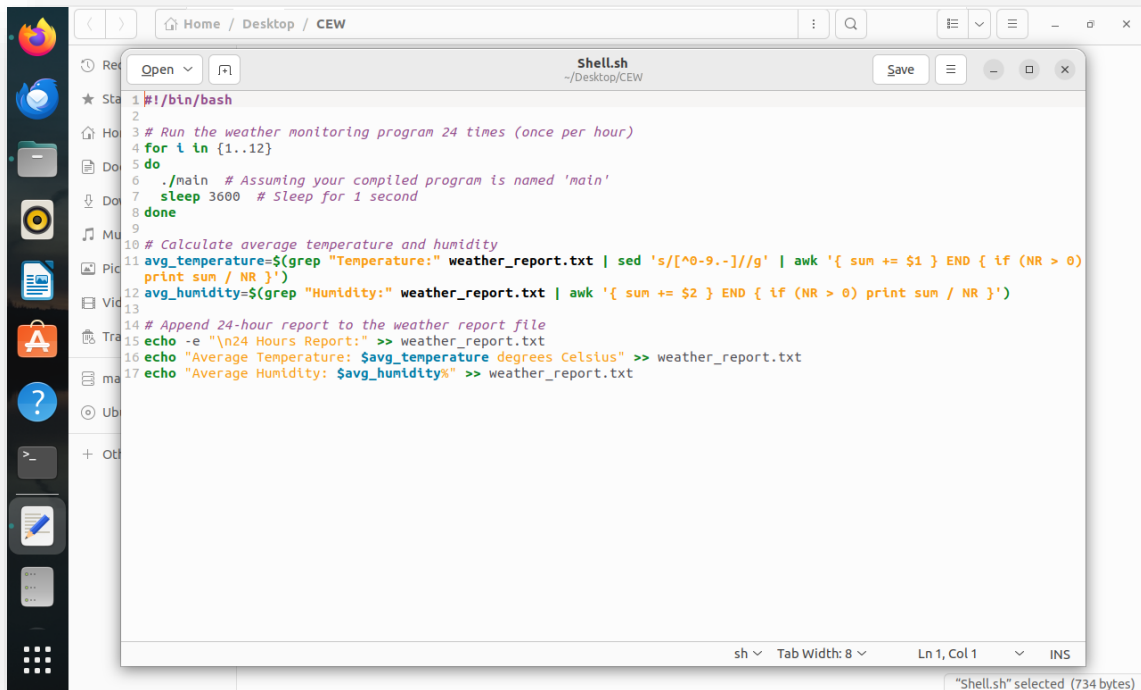


```
mehdiali@mehdiali: ~/Desktop/CEW
mehdiali@mehdiali:~/Desktop/CEW$ cd Desktop/CEW
mehdiali@mehdiali:~/Desktop/CEW$ gcc -o main main.c -lcurl
mehdiali@mehdiali:~/Desktop/CEW$ ./main
Raw data saved to 'raw_data.txt'

Processed Weather Information:
Weather in Karachi: scattered clouds
Temperature: 20.90 degrees Celsius
Humidity: 64.00%

Temperature anomaly detected!
Weather report appended. See 'weather_report.txt' for details.
Processed data appended. See 'processed_data_Karachi.txt' for details.
```

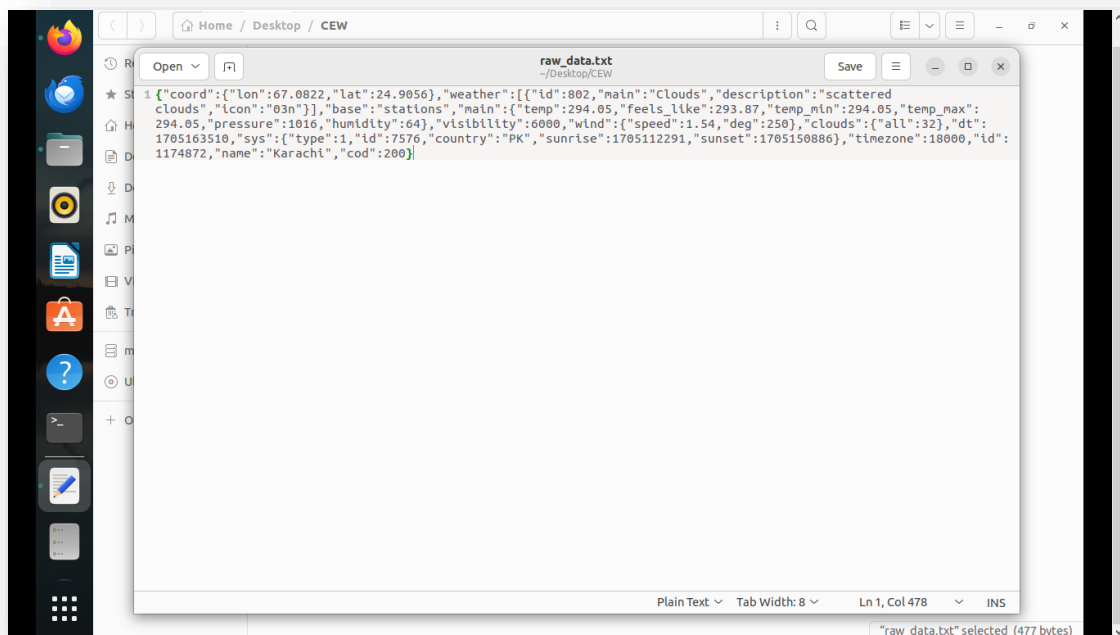
Integration of the shell script with the C program to enhance automation:



```

1 #!/bin/bash
2
3 # Run the weather monitoring program 24 times (once per hour)
4 for i in {1..24}
5 do
6     ./main # Assuming your compiled program is named 'main'
7     sleep 3600 # Sleep for 1 second
8 done
9
10 # Calculate average temperature and humidity
11 avg_temperature=$(grep "Temperature:" weather_report.txt | sed 's/[^0-9.-]//g' | awk '{ sum += $1 } END { if (NR > 0)
12 print sum / NR }')
13 avg_humidity=$(grep "Humidity:" weather_report.txt | awk '{ sum += $2 } END { if (NR > 0) print sum / NR }')
14
15 # Append 24-hour report to the weather report file
16 echo -e "\n24 Hours Report:" >> weather_report.txt
17 echo "Average Temperature: $avg_temperature degrees Celsius" >> weather_report.txt
18 echo "Average Humidity: $avg_humidity%" >> weather_report.txt
  
```

Retrieval of raw data through API:



```

1 {"coord":{"lon":67.0822,"lat":24.9056},"weather":[{"id":802,"main":"Clouds","description":"scattered
2 clouds","icon":"03n"}],"base":"stations","main":{"temp":294.05,"feels_like":293.87,"temp_min":294.05,"temp_max":
3 294.05,"pressure":1016,"humidity":64},"visibility":6000,"wind":{"speed":1.54,"deg":250},"clouds":{"all":32},"dt":
4 1705163510,"sys":{"type":1,"id":7576,"country":"PK","sunrise":1705112291,"sunset":1705150886},"timezone":18000,"id":
5 1174872,"name":"Karachi","cod":200}]
  
```