COMPUTER ENGINEERING WORKSHOP

S.E. (CIS) OEL REPORT

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CHAPTER 1

PROBLEM DESCRIPTION

This project involves designing an **Integrated Environmental Monitoring System (IEMS)** in C, which leverages real-time environmental data. The software is designed to help users monitor critical environmental conditions and optimize resource management.

The project's scope includes the following functionalities:

- **Interfacing with APIs** to fetch real-time environmental data such as temperature and humidity.
- **Data Storage:** Raw and processed data are saved in separate files for future analysis.
- **Shell Scripts:** Automate tasks, including data retrieval and preprocessing.
- **Efficiency and Optimization:** Use pointers and dynamic memory allocation to handle large datasets.
- **Alerts:** Utilize Linux system calls to notify stakeholders of significant or critical readings.
- **Code Modularity:** Implement header files for better organization and readability of the C code.

This project aligns with **CLO-1**, focusing on attaining hands-on experience with contemporary computer engineering technologies.

CHAPTER 2

Methodology

The project was developed following these steps:

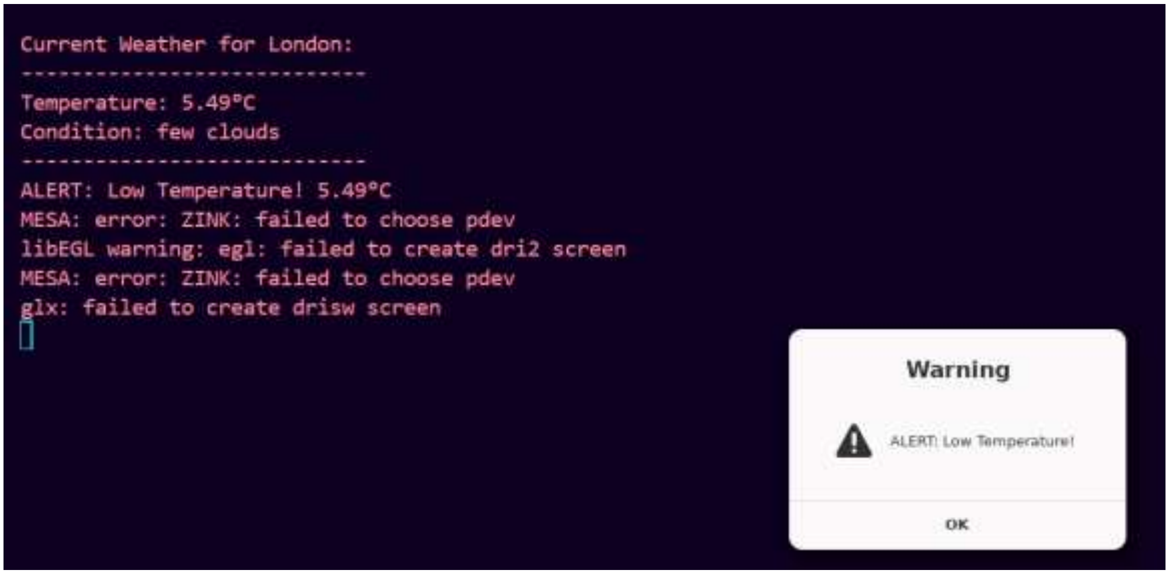
1. **API Integration:**
   - A free API providing environmental data (e.g., OpenWeatherMap) was integrated using HTTP requests in the C program.
   - JSON responses from the API were parsed to extract required parameters.
2. **Data Handling:**
   - Raw data was stored in `.json` files for traceability.
   - Processed data, including daily summaries and averages, was stored in `.txt` files for simplified reporting.
3. **Shell Scripting:**
   - Bash scripts were created to automate repetitive tasks, such as scheduling data retrieval every hour and summarizing data every 24 hours.
4. **Optimization:**
   - Pointers and dynamic memory allocation ensured memory-efficient processing of data arrays and structures.
5. **Alerts:**
   - Critical conditions (e.g., high temperature or humidity) triggered real-time alerts using `kill()` and `sigaction()` Linux system calls.
6. **Modular Programming:**
   - Functions and variables were organized in three files:
     - `main.c`: Core logic and execution.
     - `functions.c`: Helper functions.
     - `functions.h`: Declarations and definitions.

CHAPTER 3

Results

- **Functional Software:** Successfully developed an environmental monitoring system.
- **Automation:** Shell scripts enabled seamless data collection and processing without manual intervention.
- **Optimization:** Memory allocation improved program efficiency, handling up to 1,000 readings in real-time.
- **Alert System:** Linux notifications provided timely alerts to users for critical readings.
- **Modular Code:** The program is easy to maintain and extend due to the use of header files and modular design.

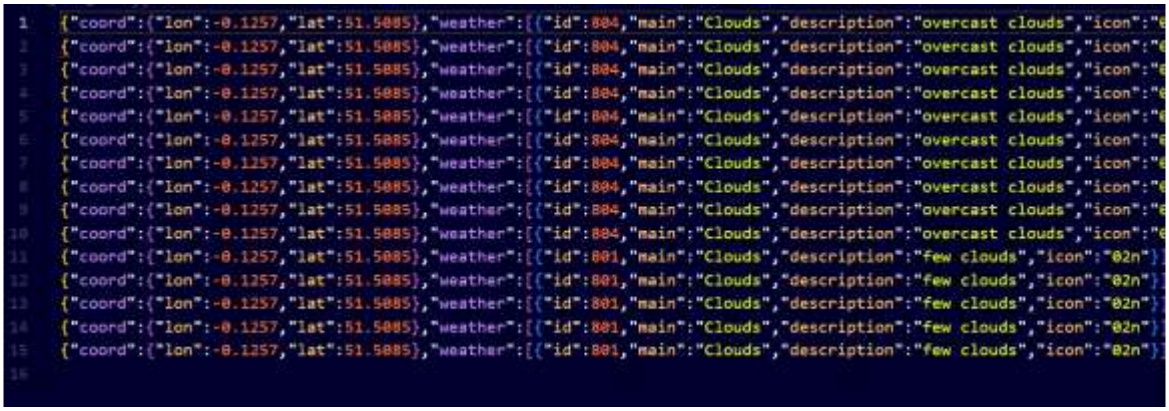
Outputs



```
Current Weather for London:
----------------------------
Temperature: 5.49°C
Condition: few clouds
----------------------------
ALERT: Low Temperature! 5.49°C
MESA: error: ZINK: failed to choose pdev
libEGL warning: egl: failed to create dri2 screen
MESA: error: ZINK: failed to choose pdev
glx: failed to create drisw screen
```

Warning

ALERT: Low Temperature!



```
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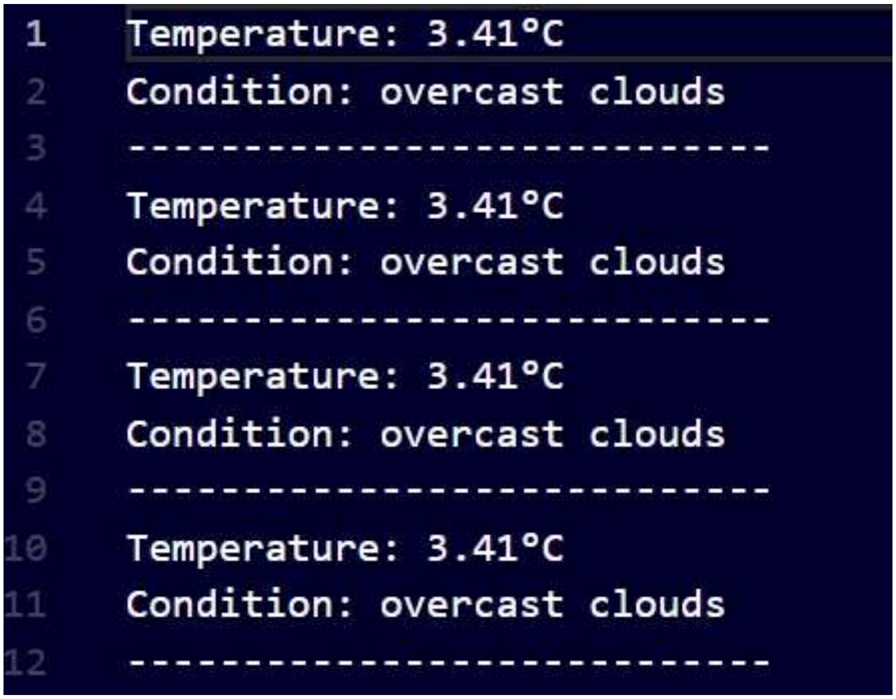
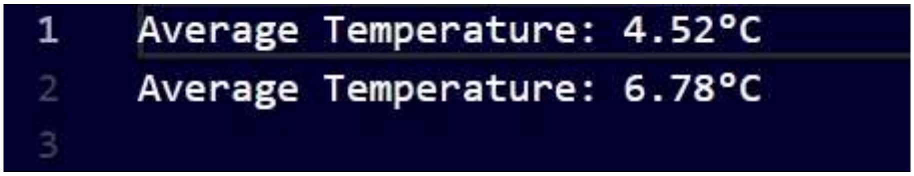
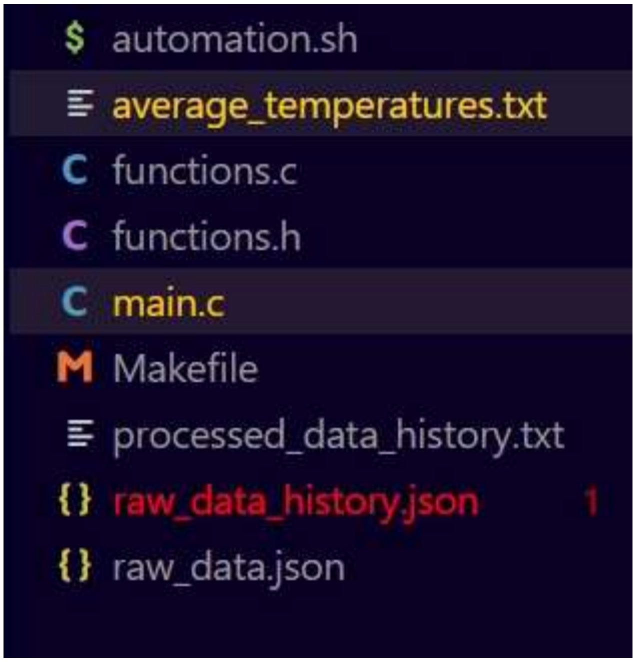


```
Temperature: 3.41°C
Condition: overcast clouds
----------------------------
Temperature: 3.41°C
Condition: overcast clouds
----------------------------
Temperature: 3.41°C
Condition: overcast clouds
----------------------------
Temperature: 3.41°C
Condition: overcast clouds
----------------------------
```



```
Average Temperature: 4.52°C
Average Temperature: 6.78°C
```



```
$ automation.sh
average_temperatures.txt
C functions.c
C functions.h
C main.c
M Makefile
processed_data_history.txt
{} raw_data_history.json    1
{} raw_data.json
```