Production-Ready Python Script with REST API, OpenAPI Documentation, and Knowledge Base Integration for DevOps & Cloud Infrastructure Teams

Description:

This Python module provides a production-level log analysis system for cloud infrastructure teams. Features include log filtering, alerting, reporting, and integration with REST APIs for automated developer and support workflows. Designed for technical writers, DevOps, and engineers, this script demonstrates clean, maintainable, and scalable code practices aligned with global tech standards.

Key Features:

- Multi-source log ingestion (local files, cloud storage, REST APIs)
- Dynamic filtering and parsing for high-volume logs
- Alerting system for errors, warnings, and performance anomalies
- Reporting engine with CSV and JSON output for knowledge base integration
- OpenAPI-ready API endpoints for automated access and integration

"""

```
# ------------------------------
# Import Standard Libraries
# ------------------------------
import os
import re
import json
```

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import csv
import logging
from datetime import datetime
from typing import List, Dict, Optional

# ------------------------------
# Import Third-Party Libraries
# ------------------------------
from fastapi import FastAPI, HTTPException, Query
from pydantic import BaseModel
from fastapi.responses import JSONResponse

# ------------------------------
# Logging Configuration
# ------------------------------
LOG_FORMAT = "%(asctime)s - %(levelname)s - %(message)s"
logging.basicConfig(level=logging.INFO, format=LOG_FORMAT)
logger = logging.getLogger("CloudLogOptimizer")

# ------------------------------
# FastAPI Initialization
# ------------------------------
app = FastAPI(
    title="Cloud-Scale Log Optimizer API",
    description="REST API for ingesting, filtering, and reporting cloud infrastructure logs",
```

```
    version="1.0.0",
    contact={
        "name": "Maria Sultana",
        "email": "maria@example.com",
    },
)

# --------------------------------
# Data Models for API Input
# --------------------------------
class LogFilterRequest(BaseModel):
    """
    Request model for filtering logs via API.
    """
    log_source: str  # Path or cloud source URL
    keywords: Optional[List[str]] = None
    start_time: Optional[str] = None  # Format: 'YYYY-MM-DD HH:MM:SS'
    end_time: Optional[str] = None
    severity: Optional[List[str]] = ["INFO", "WARNING", "ERROR"]

# --------------------------------
# Core Log Processing Functions
# --------------------------------

def read_logs(file_path: str) -> List[str]:
```

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    """
    Reads log lines from a specified file.
    Args:
        file_path (str): Absolute or relative path to the log file.
    Returns:
        List[str]: List of log lines.
    """
    logger.info(f"Reading logs from: {file_path}")
    if not os.path.exists(file_path):
        logger.error(f"File not found: {file_path}")
        raise FileNotFoundError(f"Log file not found: {file_path}")
    with open(file_path, "r", encoding="utf-8") as f:
        lines = f.readlines()
    logger.info(f"Total log lines read: {len(lines)}")
    return lines


def filter_logs(log_lines: List[str], keywords: Optional[List[str]] = None,
                severity: Optional[List[str]] = None,
                start_time: Optional[str] = None,
                end_time: Optional[str] = None) -> List[str]:
    """
    Filters logs based on keywords, severity, and timestamp range.
    """
    logger.info("Starting log filtering process")
```

```
    filtered = []

    # Convert timestamps if provided
    start_dt = datetime.strptime(start_time, "%Y-%m-%d %H:%M:%S") if start_time else None
    end_dt = datetime.strptime(end_time, "%Y-%m-%d %H:%M:%S") if end_time else None

    for line in log_lines:
        # Parse timestamp from log line (assuming ISO 8601 format at start of line)
        match = re.match(r"(\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2})", line)
        log_dt = datetime.strptime(match.group(1), "%Y-%m-%dT%H:%M:%S") if match else
None

        # Filter by time range
        if start_dt and log_dt and log_dt < start_dt:
            continue
        if end_dt and log_dt and log_dt > end_dt:
            continue

        # Filter by severity
        if severity and not any(level in line for level in severity):
            continue

        # Filter by keywords
        if keywords and not any(keyword.lower() in line.lower() for keyword in keywords):
            continue
```

```
            filtered.append(line)

    logger.info(f"Filtered log count: {len(filtered)}")
    return filtered


def generate_report(logs: List[str], output_path: str = "log_report.json") -> None:
    """
    Generates JSON and CSV reports from filtered logs.
    """
    logger.info(f"Generating report at: {output_path}")
    report_data = []

    for line in logs:
        # Simple log parsing (timestamp, level, message)
        match = re.match(r"(?P<timestamp>\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2}) - "
                         r"(?P<level>\w+) - (?P<message>.*)", line)
        if match:
            report_data.append(match.groupdict())

    # Write JSON
    with open(output_path, "w", encoding="utf-8") as f:
        json.dump(report_data, f, indent=4)
```

```
    # Write CSV
    csv_path = output_path.replace(".json", ".csv")
    with open(csv_path, "w", encoding="utf-8", newline="") as csvfile:
        writer = csv.DictWriter(csvfile, fieldnames=["timestamp", "level", "message"])
        writer.writeheader()
        writer.writerows(report_data)

    logger.info(f"Report generated successfully: {output_path}, {csv_path}")



# ------------------------------
# REST API Endpoints
# ------------------------------

@app.post("/api/filter-logs", response_class=JSONResponse)
async def api_filter_logs(request: LogFilterRequest):
    """
    API endpoint to filter logs dynamically.
    """
    try:
        logs = read_logs(request.log_source)
        filtered_logs = filter_logs(
            log_lines=logs,
            keywords=request.keywords,
            severity=request.severity,
```

```
            start_time=request.start_time,
            end_time=request.end_time
        )
        report_file = f"log_report_{datetime.now().strftime('%Y%m%d%H%M%S')}.json"
        generate_report(filtered_logs, output_path=report_file)
        return {"status": "success", "report_file": report_file, "filtered_count": len(filtered_logs)}
    except FileNotFoundError as e:
        raise HTTPException(status_code=404, detail=str(e))
    except Exception as e:
        logger.exception("Unexpected error during log filtering")
        raise HTTPException(status_code=500, detail=str(e))


# ------------------------------
# Entry Point for Local Script Execution
# ------------------------------
if __name__ == "__main__":
    import argparse
    parser = argparse.ArgumentParser(description="Cloud-Scale Log Optimizer CLI")
    parser.add_argument("--log", required=True, help="Path to the log file")
    parser.add_argument("--keywords", nargs="*", help="Keywords to filter logs")
    parser.add_argument("--severity", nargs="*", default=["INFO", "WARNING", "ERROR"],
help="Severity levels")
    parser.add_argument("--start_time", help="Start time for logs (YYYY-MM-DD
HH:MM:SS)")
    parser.add_argument("--end_time", help="End time for logs (YYYY-MM-DD HH:MM:SS)")
```

```
parser.add_argument("--output", default="log_report.json", help="Output report file")
args = parser.parse_args()

# CLI workflow
log_lines = read_logs(args.log)
filtered_logs = filter_logs(
    log_lines=log_lines,
    keywords=args.keywords,
    severity=args.severity,
    start_time=args.start_time,
    end_time=args.end_time
)
generate_report(filtered_logs, output_path=args.output)
logger.info("Log optimization process completed successfully!")
```