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Air Pollution Emission Detection Optimization System for Civil Airports Under The Background of Large Data

Zhangxinpeng[1], Kuang Jianghong[2], Lv Hongyan[3]
[1,2,3](College Of Air Transportation, Shanghai University Of Engineering Science, Shanghai 201600)

ABSTRACT: with the commercial jet transport increased dramatically, caused the people to the plane and airport pollutants more attention. Design a large data structure based on the civil airport air pollution emission system, application of the Flume, Kafka, Spark Streaming, HDFS, make the system of civil airport pollution data collection, classification, analysis, processing and storage function.
Keywords: large data system; Civil airport; Air pollution; Real-time computing framework

I. INTRODUCTIONS

Quantitative aircraft engine emissions impact on airport atmospheric pollution of the environment, measure the effect of exhaust emissions from the scope and depth, argumentation and realize sustainable development of the airport for airport construction project is of great significance. "Because of the" greenhouse effect "cause global warming has been widespread concern in all countries. For civil aviation industry, the main pollution to the environment, from the plane from the burning of fuel gases. China has become the second largest country after the United States civil aviation power. Due to the constant expansion of the civil aviation, aviation transport characteristics of globalization, as well as the international air transport energy conservation and emissions reduction factors such as increase year by year, make the civil aviation in our country is faced with the difficult task of energy saving and emission reduction.

Civil pollution data contains the ground monitoring equipment, monitoring equipment on board, video surveillance equipment, channels to produce vast amounts of data, such as the Internet, 80% of which exists in the form of the structure[1]. Traditional regional pollution through the monitoring data, environmental data, geographic data structured data such as simulation analysis, the pollution produced by the study of the airport have played a role. But due to lack for video, unstructured data such as document analysis, make its produce a certain limitations.

Without the scope of affordable time with conventional software tools to capture, manage, and process of data collection, need to deal with the new model can have better decision-making, insight found mass force and the process optimization ability, high rate of growth and diversification of information assets, that is the big data.Therefore it is necessary to adopt the analysis method under the background of big data, the design of a civil airport air pollution emission data system based on the architecture of the application of Flume, Kafka, Spark, Streaming HDFS, the system has collected, the civilian airport pollution data classification, analysis and storage function, emission of the civilian airport air pollution.

II.THE CIVIL AIRPORT AIR POLLUTION

Plane of the influence of atmospheric pollution, mainly aircraft exhaust components and analyze the atmosphere and the harm of human study. According to historical research, found mainly in aircraft exhaust emission of CO2, H2O, CO, NOX, SOX, VOCs, and many other gases and particles. JoergHelandetc in the shuttle's engine exhaust infrared emission spectrum were measured, and the establishment of a jet exhaust level model, analysis of the main components of the aircraft combustion exhaust gas CO2, H2O, CO, NO, N2O, etc[2].

The plane 's taxi on the runway landing (brake), and to fly (open) engine waiting, take off. A Boeing 747 passenger plane weighs about 425 tons, round off the normal landing, taxiing, took an average of 32 minutes, oil fired about 4000 kg (about 5000 liters), each release 8400 litres of waste gas heat 1 litre. Take off from the ground when the 2 minutes of exhaust gas emissions equivalent to 3000 cars. Best when flying at high altitude jet engine efficiency, basic only carbon dioxide; But on the surface of the combustion efficiency is very poor, incomplete combustion, as well as carbon dioxide in the exhaust gas, and nitrogen oxide (NOX), volatile organic compounds (VOCs) and aldehyde, 1, 3 - butadiene and so on more than two hundred kinds of toxic substances. Nitrogen oxides produce photochemical smog pollution, was the cause of gray haze, and combined with the water in the air into nitrate and nitric acid, acid rain formation; Nitrogen oxides will also stimulate the

lung, can lead to lung structure change. In 32 minutes of landing is the departure time, a Boeing 747 produce nitrogen oxides (NOX)

About 87 kg. A large international airport, the take-off and landing aircraft each year hundreds of thousands of vehicles (52 vehicles in 2010, the Beijing capital airport, Shanghai pudong vehicles/hongqiao 22 330000, guangzhoubaiyun vehicles (33), a year only aircraft take-off and landing process of nox emissions alone SiWuWanDun (2010 national motor vehicle nox emissions by 5.99 million tons)[3].

Ground support equipment and parking lot vehicle emissions, relative to the airport and the surrounding is non-point source pollution, is a point source relative city. Airport is the largest passenger and cargo traffic in the city center, every year nearly hundred million people of passenger flow, millions of tons of goods (Beijing capital international airport in 2010 of 73.95 million passengers and 1.55 million tons; the pudong district of Shanghai, 40.57 million/hongqiao 40.57 million person-time,; 323/48 ten thousand tons of guangzhoubaiyun 41 million, 1.15 million tons), airport actual day and night in a vortex of high concentrations of car exhaust and smoke. Them with the aircraft taking off and landing phase of the emissions caused local air pollution, harm to human beings with automobile exhaust can do the same. But in airport ground support equipment, the use of coal-fired boiler is the main pollution equipment, coal-fired boiler will produce three kinds of waste gas, dust and waste water pollution, on the atmosphere, water, environment and human health hazards.

III. THE BIG DATA SYSTEMS

3.1 The system overall design

This study system data acquisition part adopts cloudera Flume system of the company[4]. The Flume to support the huge amount of data collection, and can be customized data receiver. Because maintenance related data source is different, different format, based on the data by Kafka buffer and do further processing[5], the data after the processing using the unified format, sent to Spark Streaming data processing engine[6], Spark Streaming can satisfy the demand of large data processing, through the rich API, the execution engine was analyzed based on memory, provide the airport air pollution forecast, monitor the airport near ground air, the data collected and processed data, stored in a distributed file system (HDFS)[7]. The integral design of the system block diagram is shown in figure 1.

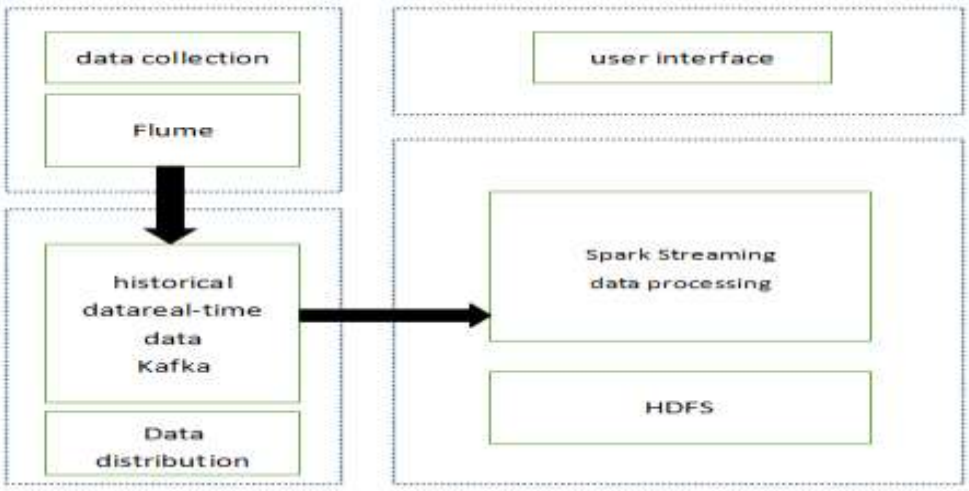

Figure 1 overall design block diagram of the system

3.2 data collection

Airport, the causes of air pollution has a lot of, for example, in the process of the planes land and take off engine exhaust, also may be that the exhaust gas produced by ground facilities such as passenger cars, etc. Due to the weather and staff activity, the system needs to gather historical data on a fixed date, at the same time need real-time pollution data, these data from different size and form.

Flume is Cloudera provide a high availability, high reliability, distributed mass log collection, aggregation and transmission system, the Flume support custom all kinds of data in the log system sender, used to collect data. At the same time, the Flume provide to simple data processing, and writes the ability of various data receiver (customizable). System using the Flume - ng as a data acquisition system, to collect a variety of different sources of air pollution data, and data integration in together.

3.3 data classification

Aircraft exhaust emission of CO2, H2O, CO, NOX, SOX, VOCs, and many other gases and particles are different equipment testing and data transmission. Will these get to the air pollution data classification is helpful to better processing and management.

Kafka is a high throughput of distributed publish-subscribe messaging system, it can handle all the action flow data in site. These data are often due to the requirement of throughput by processing the log and log polymerization to solve. The purpose of Kafka is unified by the parallel loading of the Hadoop mechanism of online and offline message processing. System adopts Kafka, classified pollution to collect good data processing, data will be distributed to real-time processing engine, a strategy after processing by the user, the data in a balanced and under the premise of sequential and distributed to different queue.

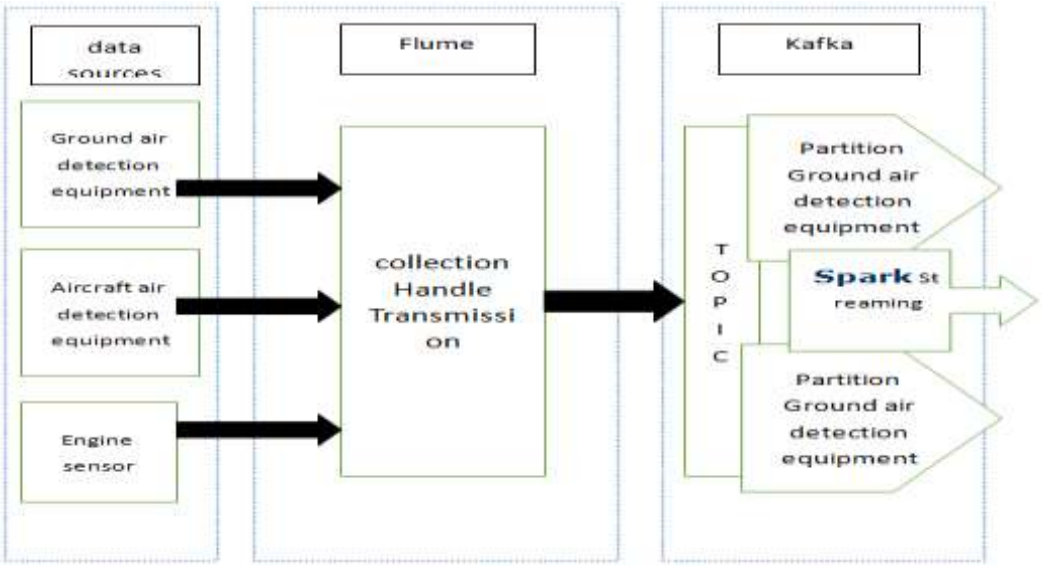

Figure 2 classification of data acquisition system

3.4 The Real-Time Data and Real-Time Data

After the data collection process to collect real-time data and historical data, because the airport air pollution a greater difference between the amount of data real-time data and historical data, pollution source diversification, the analysis of the methods are also different, so the system needs to be divided into two parts (not) real-time data and real-time data processing.

Through the analysis of the emissions of engine sensors on the historical data, historical data records pollution detection equipment and airport pollution testing facilities history data, to analyze the causes of air pollution in the airport and the airport, the influence of the system for the great amount of data and time-consuming longer non-real-time data taken offline processing, through the data mining, feature extraction methods such as evaluation airport air pollution levels, after processing the data stored in the database directly convenient researchers after comparison and analysis, and management optimization scheme of the airport air pollution are put forward. By aircraft and ground sensors will real-time information about pollution such as aircraft landing state, such as the weather changes under the condition of pollution discharge data is passed to the real-time analysis system, real-time data because of the relatively small amount of data, directly using real-time processing, researchers can obtain the data after processing in time, put forward the best optimization scheme for the crew, the aircraft using the optimal discharge scheme under the running state.

With the development of big data, people has higher requirement for large data processing, the original batch framework graphs suitable for off-line calculation, cannot satisfy the real-time requirements of higher business, according to the facts when recommend, user behavior analysis, etc. Spark Streaming real-time computing framework is built on the Spark, through it provides rich API, the execution engine based on memory, the user can combine Streaming, try the batch and interactive query applications. So this article USES the Spark Streaming as the data processing engine. Spark Streaming is the basic principle of the input data stream in time (in seconds) for the unit to split, and then in a similar way of batch process each time data. The following figure 3 for Spark Streaming basic principle diagram.

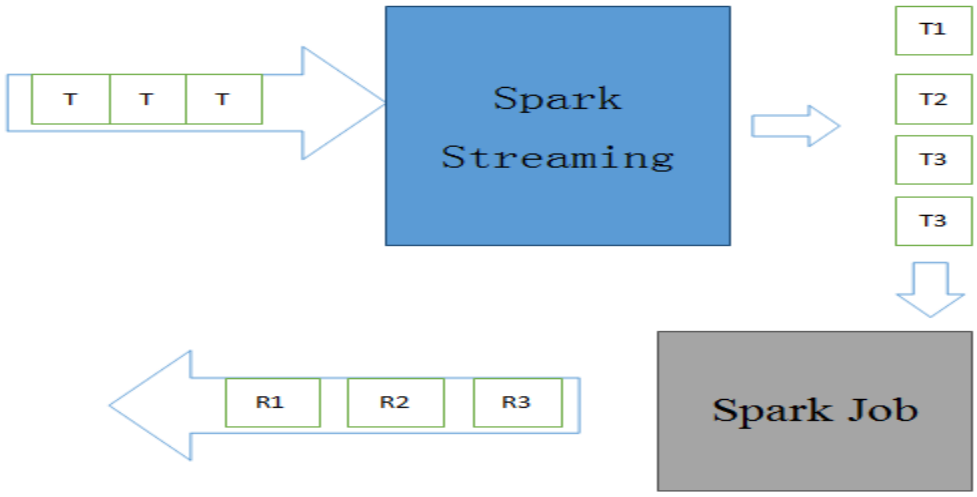

Figure 3 Spark Streaming basic principle diagram

3.5 Data Security Stability

After collecting and processing the data needs to be stored in the system, the current mainstream of parallel file system including the HDFS, KFS, CEPH, PANASAS, HDFS is a highly fault-tolerant system, suitable for deployment in cheap machine. HDFS can provide high throughput data access, very suitable for the application of large data sets. This study USES HDFS as saving data storage system, to a large number of pollution, flight and the weather has a strong ability to store data.

3.6 The User Interface Design

For the convenience of the researchers, working in different areas to evaluate the airport air pollution and put forward the optimization scheme, the user interface using web design, each department called pollution data points access by user login system, make managers and researchers have a clear division of responsibilities, ensure system safety, under the condition of reasonable control pollution levels at the airport.

IV. THE CONCLUSION

Civil airport air pollution emission, this paper designs a set of airport pollution detection based on large data structure optimization system, the application of the Flume, Kafka, Spark Streaming, HDFS data architecture solves the airport pollution classification of data collection, data transfer, data processing and storage. Use of big data, real-time and non real-time conditions for pollution data processing analysis, for the researchers later it would be helpful to the analysis of the causes of pollution. Using this system can make the economic benefits of the airport in the airport cases, improve the level of the airport environment.

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