Design of Four –wheel alignment information storage and query

Ji feifei[1], Xie xiaolan[2]

[1]College of mechanical control and engineering, Guilin university of technology，Guilin,China

[2]Institute of information science and engineering, Guilin university of technology，Guilin,China

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Abstract. Four-wheel alignment is an important parameter in design of automobile structure, directly affects the driving performance of a car. In view of the current vehicle four-wheel alignment and vehicle application using case, in this paper it introduces a kind of query design pattern of the four-wheel alignment information storage based on the Hadoop framework , to improve the quality of four-wheel positioning maintenance, especially can play a positive role to improve road safety.

1. INTRODUCTION

With China's rapid economic development, people's living standards continue to improve, the number of car ownership is increasing year by year, a series of problems caused by cars followed, of which the most attractive is the car safety problem. Automotive wheel alignment technology by adjusting the angle of the car related to wheel and kingpin, etc., can effectively solve the car due to wear, corrosion and other causes of automobile driving performance degradation problems, so as to ensure the vehicle driving safety and improve the driving comfort of light.

2. FOUR-WHEEL ALIGNMENT INTRODUCTION

2.1 Four-wheel alignment current situation

Since the German Daimler-Benz carried out the invention of a car in 1886, the car used in the western countries has spanned nearly 130 years, the wheel alignment technology with the development and progress of the car, and constantly improved development. Automotive power, including the United States, France, Germany, Japan, etc., in the 1950s developed the detection and diagnosis of automotive wheel alignment equipment. Now formed from the traditional measurement techniques such as toe-foot measurement, optical measurement standards, cable measurement, laser measurement, CCD measurement, to the development of measurement techniques based on computer vision 3D images locator.

China's auto industry started relatively late , in 1960s China began to introduce Bench locator, related companies and research institutes have also increased research efforts. So far, though so our four-wheel alignment of the formation of a variety of models, a variety of range situation, but our country's wheel alignment sensor mostly through purchased abroad, then assembled by ourselves in the company, lack of innovation, so our wheel positioning technology is still in its lack of independent intellectual property stage, the market is still the dominant position of foreign products.

2.2 Four-wheel alignment parameter analysis

1 Caster. Caster angle is observed at the connection to the top of the ball head or the ball from the side pillars of the vehicle (assuming a steering axis) is inclined forward or backward, shown in Fig.1b, the angle between the vertical axis and the ground. The main function of caster is to keep the vehicle to drive straight ahead. caster angle does not affect tire wear, it is used to stabilize the vehicle running direction and can automatically back positive.

2 Kingin Iclination. Kingpin Inclination refers to the angle between the axial centerline and the vertical line in the car’s lateral plumb surface projection, turning inward to the center line of the upper is positive, outward negative. Kingpin inclination and caster is similar to the function, can improve the steering automatically back, when driving on the concavo-convex surface road,Kingpin Inclination, also can reduce the impact. When the left and right sides of the kingpin obliquity is not

equal at the same time, vehicle will draw to the side of smaller kingpin inclination in the running process.

3 Camber. Observed from the front of the automobile, the angle between the geometric center line of the wheel and the ground vertical line is called the camber angle. The camber angle can be positive, negative, zero value. The camber by setting reasonable, can be in when fully loaded with camber comprehensive introversion angle, ensuring tires and ground maintain maximum vertical contact, reducing wear and tear in the process of moving.

4 Front Toe. The vehicle is viewed from observation Fig.1a, the front-end distance is B and back-end A , if B <A, then known as the front toe; B> A, then called the front before the show. The angle between the centerline of the front wheel (the wheel center and the ground plane intersects the line of intersection) and the longitudinal centerline called toe angle. Toe is in line with the camber, in order to reduce the car's wheels rolling in the process of running and reduce tire wear.

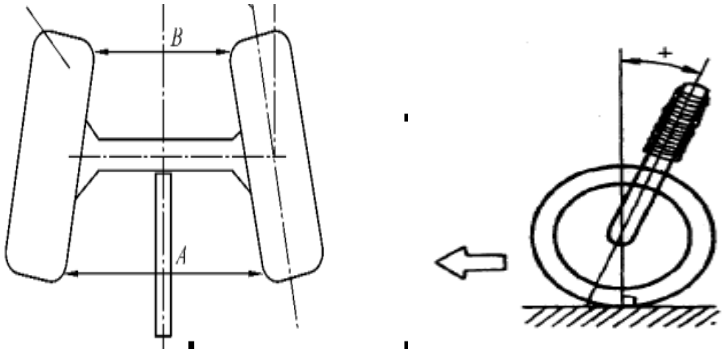

Fig.1 a Front Toe b Caster

3 . HADOOP FRAMEWORK APPLICATION

With the wide application of e-commerce, ocean exploration, social networks and other large data platform in recent years, massive business data, Web data, and the rapid increase in scientific data, and isomerization (structured / semi-structured / unstructured), traditional relational database processing these data appeared to be inadequate, or simply incompetent. Since 2003, Google gradually published GFS, MapReduce framework and other relevant papers, and claimed that the use of these technologies to expand their search capabilities. This paper describes the GFS, MapReduce framework are not only highly scalable, high-performance advantages, the most important is that users do not have to care about the inner complex workings. Doug Cutting employ Google's idea about MapReduce and then make it become open source. Hadoop also because of its excellent distributed file storage systems HDFS and data processing MapReduce performance model known to the world.

3.1HDFS

Hadoop Distributed File System HDFS uses master / salve mode, an HDFS including a NameNode, a Secondary NameNode, several DataNode, shown in Fig.2. NameNode as master, DataNode as a salve, NameNode is responsible for maintenance of the system namespace, operation, mapping database , recording namespace access when alterations. DataNode is relatively busy node in HDFS, primarily responsible for receiving commands from the NameNode and perform the appropriate data block operations, and communication between the client and others DataNode. Secondary NameNode is NameNode' auxiliary node in the system, Secondary NameNode is a daemon using to monitor HDFS state. Secondary NameNode but does not receive and record changes in HDFS, but by communication with NameNode to obtain HDFS metadata snapshots at regular intervals. When the cluster fails, the system will copy the task' logs to recover the data block processing, the re-tasking, reducing the risk of data loss. As Hadoop underlying file system, HDFS have a lot of advantages ,such as GB, PB large file storage capacity and supports the streaming access, high fault tolerance, good portability, low operating costs, code migration and so on.

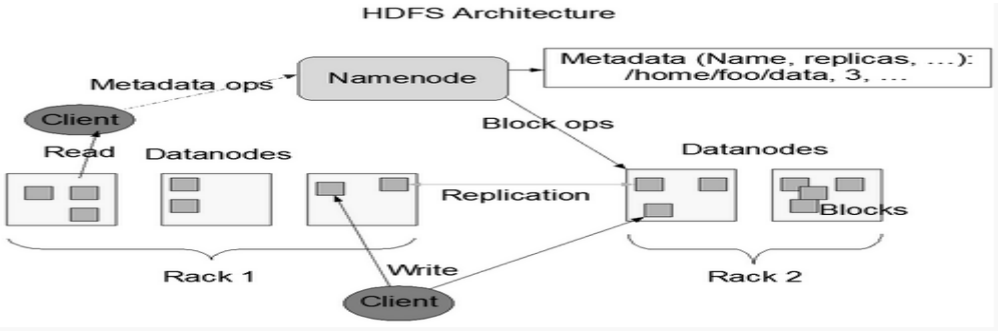

Fig.2 HDFS Architecture

3.2 MapReduce programming model

Hadoop's MapReduce is inspired by Google's related papers about MapReduce. MapReduce's goal is to parallel process massive data sets, the model is relatively simple. based on user-defined Map () function, Reduce () functions, MapReduce model executes Map and Reduce stage, when the data entered in the MapReduce system will default to convert <key, value> pair, in the Map stage ,data are splited, the one set of data is mapped into another set of intermediate statistical results easily, and run on multiple DataNodes, intermediate results are stored waiting for further processing in the memory. In the Reduce stage, by accepting commands and functions handling requirements, Reduce () functions call intermediate results in memory, then the same results are combined ,finally ,output to the user a smaller-scale data sets. If the data size is still relatively large after MapReduce processing, we can consider using Combine () function. Combine can execute Reduce () similar operation, it can downsize the numbers of data sets before Reduce processing greatly reduces network congestion when the intermediate result of the transmission.

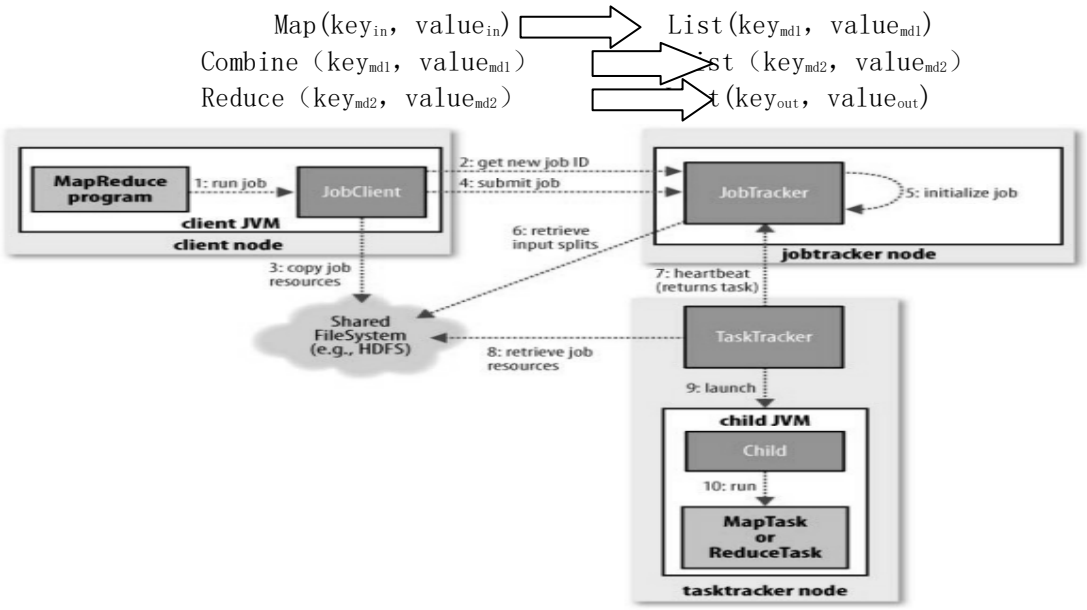

Fig.3 How Hadoop runs a MapReduce job

A MapReduce job execution procedure generally consists of four steps: job submission, job initialization, task allocation, task execution,Fig.3. JobClient is responsible for submitting the job, Jobtracker responsible for operations coordinating, Tasktracker run tasks that through the division, distributed file system HDFS responsible for store related data. through a complete processes, MapReduce final complete a customer's jobs, and outputs the results to the client.

4. HBASE

Hbase derived from Google Bigtable thought, is a database of between NOSQL and RDBMS, with high reliability, scalability, high performance, dynamic column storage, real-time read write and other characteristics. In 2010,Hbase emerged from Hadoop subproject as the top-level project

of Apache, coordinated by other projects in the Hadoop ecosystem, we can maximize the realization of Hbase performance.

The data is stored in the form of a table in the Hbase, the table using Row key, ColumnFamily, Column key and Timestamp indexed. the Row keys control row's specific location and data access in the table; physically the same column family members are placed in the same file system, which will help to improve the compression ratio, help to reduce I / O overhead, etc; Column support user to design table that be different from the traditional database design, after determining column family, according to user business needs, you can dynamically add Hbase row, column, the version number to the four-dimensional direction (Hbase cell does not store null values, in this regard you can save a lot of overhead), you can reach one million, or even one hundred million columns. shown in Fig.2 is Hbase architecture.

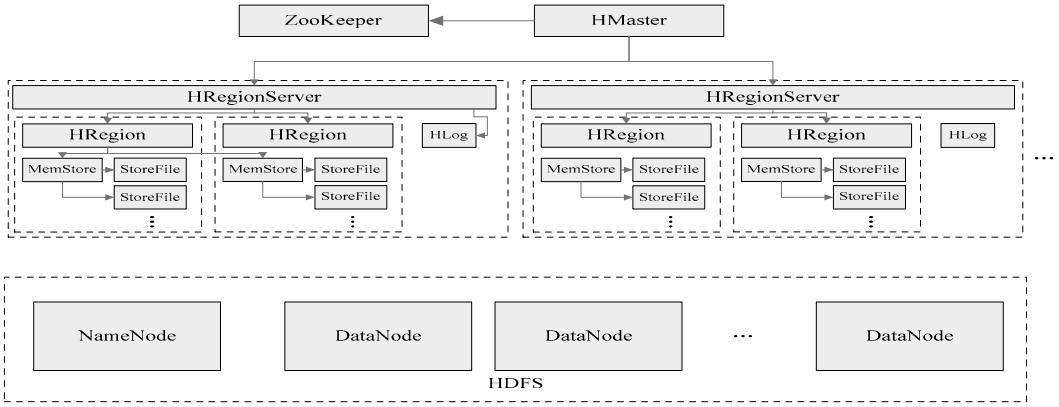

Fig.4 Hbase Architecture

5. MODEL IMPLEMENTATION

Through this model realized four wheel alignment data (text, images, etc.) into Hbase, support real-time queries, fast response, high fault tolerance, and according to the increase in business, good cluster scalability. using Hbase based on Hadoop platform to store massive data is just to meet above functions, and has the economic and technical feasibility.

Due to the presence of Hadoop cluster time delays between different devices, NTP is installed in Linux in this model and set the NTP server and synchronous machine, with automatic time synchronization function to reduce the impact of cluster time delay.

In order to realize a simple data access, this model is designed to unify more than one type of data interface. So that users need not concern the complex details of data storage, all the details of the work due to the system to handle automatically.

According to the characteristics of Hbase table and columnfamily, The same columns which are easy to appear at the same time when query happen are distributed in the same column family in this design. As much as possible to reduce I / O overread, improving the response time of the system to customer requests.

We use WindowBulider's SWT graphics window function to design query window, using good portability of the Java programming language, so that the query window to better adapt to different local operating system to reduce the amount of labor code compilation.

6. CONCLUSION

The original data of the present stage of our country automobile four-wheel alignment and analysis of accidents data are scattered in different area and different types of cars, different ages of four-wheel alignment systems. with this model, we can use existing resources to achieve these clustering process of large-scale data, making data easier to obtain ,more accurate and efficient. Conducive to maintenance companies to improve service levels, also help customers to deepen awareness of car and improve driving safety. In the long run, through data collection, to

provide technical support for future regional road conditions, vehicle / mileage wear, suspension improvements.

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