DEVELOPING AN ANDROID-BASED ADAPTIVE DATA ACQUISITION SYSTEM POWERED BY BIG DATA ANALYSIS

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ABSTRACT

The traditional approaches to transportation data collection have been associated with low accuracy especially in adaptive conditions. To overcome this shortcoming, we suggest an analysis of adaptive data acquisition technology for Android systems using big data analytics. We propose the integration of Android systems into big data analysis frameworks, construct a data transmission processing framework for Android systems, and realize the efficient collection of transportation data. By the use of algorithms, we are able to distinguish between normal, useful, and useless data during the data collection process. The evaluation results show that the adaptive data transmission technology for Android systems, which is suggested in this paper, provides an analysis accuracy of about 50% and allows for the effective gathering of relevant transport data.

1. INTRODUCTION

According to the Wild Encyclopedia, big data refers to data sets that are so large and complex that traditional database management systems can barely handle them [1]. In Chinese, it refers to a dataset of such size that it presents difficulties in database management and utilization. Big data was not always called big data; instead, it used to be called massive data, and the concept was born as early as 2008. In that year, the famous magazine Nature published a special issue on the future of technology and the analysis of enormous volumes of data, and for the first time, the term Big Data was used.

In the process of development of big data, Google launched the open mobile phone developer alliance in 2007, involving many software and hardware development companies from all over the world. Later, the alliance stated that it plans to develop applications for the Android platform [2]. The shift from the paid license model that Google employed to the open source model meant that hardware and software companies incurred lower expenses and that Android smartphones became more cost efficient. The first version of the Android operating system, Android 1. 0, launched in September 2008. Google introduced the second version of Android in May 2009, which led to the frequent updates and usage in different aspects of people’s lives.

2. DESIGN OF ADAPTIVE DATA ACQUISITION TECHNOLOGY FOR ANDROID SYSTEM

The Android system in big data analysis is a collection of various data sets, which is problematic for traditional data mining and processing methods [3].

2.1. Data Processing Capabilities of the Android System

The Android system for big data analysis exhibits four principal data transmission features, encapsulated by the four Vs: Volume (high quantity), Variety (diversity), Value (low value density), and Velocity (high rate of flow). Table I below details the specific attributes of these four features.

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Table I data processing features of the android system

Data processing features	The content of the basic features
Volume	Large data is a large volume of data
Variety	Large data have a lot of data categories
Value	Compared with traditional data, the value created by big data is lower than that generated by unit data.
Velocity	The speed of generating and updating large data is very fast

Through Table I, we observe that the initial step involves amassing a substantial volume of data when employing the Android system for adaptive data acquisition technology. This stems from the vast storage capacities of big data, measured in units such as P (1PB = 1024TB), EB (1EB = 1024PB), and ZB (1ZB = 1024EB). Notably, a single Internet company like Baidu processes nearly 100 PB of data daily, akin to the cumulative information contained in the libraries of 5,000 countries. Hence, employing the data analysis capabilities of the Android system ensures ample storage availability [4]. Additionally, when using adaptive data acquisition technology via the Android system, we compute the data's value density, defined as "data value density = data value/data volume" [5].

2.2. Architecture for Collecting Transmission Data by the Android System

The architecture utilized by the Android system, rooted in extensive data analysis, for collecting and transmitting data primarily comprises three tiers: the application layer, the application framework layer, and the system runtime layer [6].

Firstly, the application layer leverages the Android system to gather informational data from core applications such as email clients, SMS, calendars, and contacts. These applications are typically coded in Java and operate on the Dalvik virtual machine unique to the Android ecosystem [7].

The subsequent layer is the application framework layer, furnishing developers with an extensive array of API resources vital for acquisition technology. These resources encompass Activity Manager, Window Manager, View System, Resource Manager, and Content Provider.

Lastly, we encounter the system runtime layer. Android relies on Java as its core library and application development language. It also incorporates the Dalvik virtual machine, tasked with executing Android applications [8]. Furthermore, the Android system utilizes C/C++ function libraries, which are used for both driver and underlying development. These system functionalities establish a robust foundation for the operation of adaptive data transmission technology. The architecture diagram illustrating the collection and transmission of data by the Android system is shown in Fig. 1.

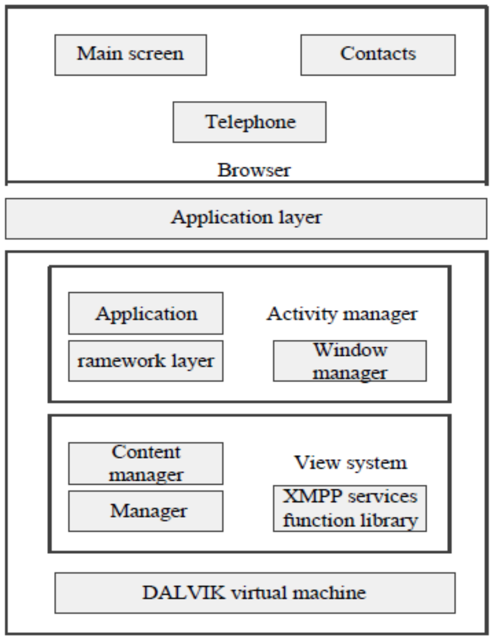

Fig.1 Android system to collect and transmit data system

Fig 1 illustrates the architecture of the Android system designed to collect and transmit data. Once familiar with the composition and components of each acquisition technology, we can comprehensively understand the data processing flow within the Android system. The specific flowchart is depicted in Fig 2.

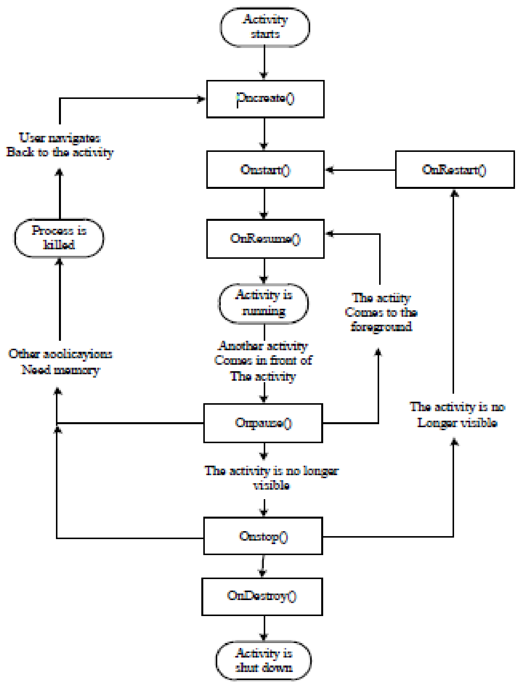

Fig.2 Android system to collect and transfer data flow

3. Algorithm for Transportation Data Collection

Data collection stands as a pivotal concern in the adaptive data acquisition technology of the Android system, rooted in big data analysis. Without effective data collection, information access remains elusive. Consequently, the linkage between objects and networks is disrupted, hindering the emergence of big data-driven intelligence. Data collection must adhere to a self-controllable secure data system and employ acquisition devices within the Android system leveraging big data analysis [9]. This process is primarily divided into two stages: the first stage involves the collection of common transportation data, while the second stage pertains to valuable data transportation.

3.1. Common Transportation Data Collection

Initiate the transportation collection system by sending a command, opening the system for data acquisition until the acquired data information X satisfies the condition:

$$X \geq (X_1 + X_2)\frac{1}{n} \quad (1).$$

$$X_1 = \sum_{i=1}^{n_1} t_i \quad (2)$$

Upon meeting this criterion, issue a command to halt the acquisition technology system. If the transport acquisition system operates in smart mode, manual controls are disabled. Subsequently, all common data is collected using Formula (1), where X denotes the acquisition result of ordinary data, 1X and 2X represent the storage coefficient and flow coefficient of the original data, respectively, and n signifies the transport coefficient.

3.2. Valuable Transportation Data Collection

Following the general data transport formula elucidated in Formula (1), proceed to collect valuable transportation data and make targeted selections. In this context, valuable transportation data is denoted as Y, and the formula for calculating Y is:

$$Y = \sum_{i=1}^{n} (X_i - \bar{X})^2 \quad (3)$$

The analysis compares traditional acquisition and transportation data technology with Android system transmission data adaptive acquisition technology through comparative simulation tests of diagnostic accuracy.

3.3. Test Data Preparation

Experimental state parameters are set to ensure experiment rigour and seven transportation data sets are chosen. One data set is useless, three are valuable, and three are ordinary. The results of parameter setting are presented in Table II.

Table II Test parameter settings

Data parameters	Whether or not to collect	It must be explained
Button	yes	The first class menu array, the number is 1-3
Sub button	no	Two level menu array, the number is 1-5
Name	yes	menu title
Url	Click click type	Menu key value for message push
Key	Llew type	network connection
Media ID	Media type	Invocation of the new material interface
Type	yes	Menu response action type

3.4. Analysis of Test Results

During testing, the adaptive acquisition system applies both traditional acquisition and transportation data technology and Android system transmission data adaptive acquisition technology. The accuracy of each collected data point is analyzed. By tracking changes in accuracy, statistical analysis yields test results, depicted in the simulation curve of analysis accuracy (Fig. 3).

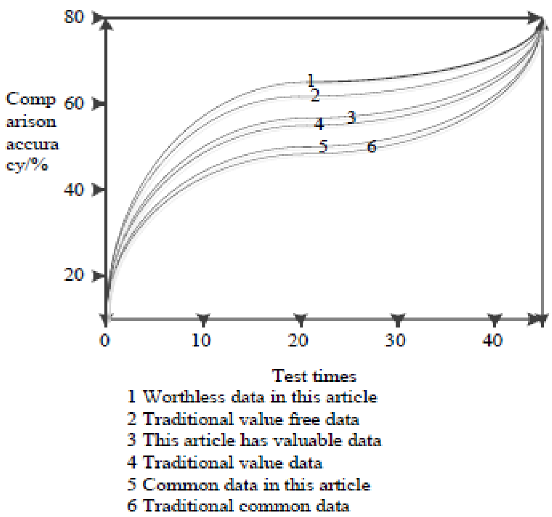

Fig.3 Analysis accuracy curve

In Fig. 3, three comparisons are made: curves 1 and 2 illustrate accuracy comparisons for valuable transportation data collection; curves 3 and 4 depict accuracy comparisons for valueless transportation data; curves 5 and 6 compare accuracy for general transportation data collection. It's evident from Fig. 3 that the collection technology presented in this paper outperforms traditional methods. Notably, the accuracy rates of the first four curves mostly exceed 50%.

4. CONCLUSIONS

This paper proposes an Android system's adaptive data acquisition technology based on big data analysis. The construction of the Android system and the algorithm for data collection and transportation achieve adaptive data collection and analysis of transmitted data. Experimental data demonstrate the high analysis accuracy of the proposed adaptive acquisition technology. This research provides a scientific theoretical basis for data collection and analysis.

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