

Retraction

Retracted: Software Development Data Analysis and Processing under the Internet of Things Monitoring System

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] J. Li, L. Zhang, and X. Tang, "Software Development Data Analysis and Processing under the Internet of Things Monitoring System," *Journal of Control Science and Engineering*, vol. 2022, Article ID 4241910, 7 pages, 2022.

Research Article

Software Development Data Analysis and Processing under the Internet of Things Monitoring System

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In order to solve the problem of highly extensible vibration test data acquisition and analysis, the author proposes a method for software development data analysis and processing under the Internet of Things monitoring system. The software platform is mainly designed through the design of software architecture based on multitask operation, active window design, reserved API interface and hardware universal design; it ensures the strong expansibility of the software platform, so as to realize the universality of the software platform. High-level vibration data analysis software designed based on this platform, such as modal parameter identification and dynamic load identification software, can be easily redeveloped by using the existing functions and software architecture of the platform, expand software functions, realize more complex vibration data analysis and processing, reduce repetitive labor, and speed up the software development process. The results showed that: the amplitude error is less than 4%. *Conclusions.* The feasibility and availability of software development data under the IoT monitoring system are verified.

1. Introduction

With the progress of society and the application of modern technology, it is quite necessary to apply computer software development technology to the analysis of the Internet of Things data system [1]. The use of computer software development technology can scientifically and efficiently analyze the data in the IoT data system and detect the perfection of the IoT data system to ensure the normal use of the IoT data system [2]. At the same time, the application of computer software development technology to the Internet of Things data system can promote the application of computer software development technology; and expand the application prospects of computer software development technology [3]. Through research on computer software development technology, the efficiency and security of IoT data system management can be improved [4].

In order to develop and design network security software based on the big data analysis environment, it is necessary to layer the logic first; logical layering needs to be carried out at

three levels of information transmission: information extraction and network port docking [5]. By establishing a logical database, information classification storage, data extraction, and network port docking can be realized [6]. And isolate the data required by different functions to avoid interference in the data transmission process [7]. After the logical layering, the functions corresponding to different databases will also be in an isolated state, in the process of software use, massive data is downloaded through the network platform, and the security of the data needs to be checked in a short time [8]. The results obtained from the initial inspection show that there is a problem of insufficient information accuracy in the logic layer, and the risk source will be judged to avoid problems affecting security during the use of data and information [9]. In the process of control and management, the database layering can automatically connect to the received function requests, and through the logical layering method, it helps to ensure the security of the software operating environment to the greatest extent. The final link of logical layering is database layering, and the

corresponding areas of the database are divided according to the mathematical modeling method [10]. In the big data environment, after the software receives the data transmission request, it will automatically start the corresponding database, and through this method, the efficiency of logic processing during the software operation process is ensured to the greatest extent [11].

The application of computer software development technology to the management of the IoT data system is beneficial in improving the data accuracy of the IoT data system, and at the same time, in order to improve the efficiency of the IoT data system to manage data [12]. Computer software development technology can create a safe information storage environment for the data processing system, by incorporating innovative management concepts; it can summarize and analyze the information in the system, and formulate a correct development path for the industry [13]. With the development of modern society, computer software development technology also needs innovation, it is necessary to meet the development of the market, improve the diversification of technology, and improve the efficiency of computer software development technology in various industries, so as to expand the application prospects of computer software development technology [14].

2. Literature Review

At present, the world is ushering in a period of great development and great change in digital transformation, the new generation of information technology accelerates and leads breakthroughs in technological applications, bringing about major changes in industrial forms, organizational management, and social governance, the development of next-generation technologies such as the Internet of Things brings new impetus and opportunities for the development of the digital economy [15]. However, compared with the United States and European countries, China started late in the development of the Internet of Things and is currently in a period of rapid development, technology hotspots continue to emerge, and certain breakthroughs have also been made in some fields, however, fragmented development, external dependence of core technologies, and security issues have always been stumbling blocks hindering the development of IoT technology [16]. Therefore, it is urgent to carry out a systematic analysis of the Internet of Things technology system, analyze the key technologies in the field, and judge the development trends and hotspots of the Internet of Things, and formulate targeted policy measures to promote the continuous innovation and healthy development of the Internet of Things, helping the development of the real economy [17].

The Internet of Things technology presents the characteristics of integrated development, integrated innovation, large-scale application, and ecological acceleration, and hot technologies continue to emerge [18]. Networks and platforms accelerate large-scale deployment, laying the foundation for the comprehensive promotion of the Internet of Things. At present, the Internet of Things technology is in

the stage of integration and development, and the technological system is being restructured at an accelerated pace, the large-scale deployment and network technology of IoT WAN continue to break through. There are a lot of vibration problems in the field of modern engineering technology, the study of the characteristics of mechanical vibration can help researchers to better improve the working performance of machinery, avoid engineering problems caused by harmful vibration, and improve efficiency. Therefore, vibration testing, analysis and research have always been the focus of researchers. With the development of the times, traditional instruments are gradually unable to meet the development needs of vibration testing and analysis disciplines based on the unfavorable characteristics of hardware, poor mobility, and high cost. Therefore, software-based vibration test acquisition and analysis will increasingly become the mainstream in this field in the future.

Different from the previous LabVIEW-based vibration test acquisition and analysis software design, the design of data acquisition, signal analysis and processing, file storage, human-machine interface design, and other modules is being studied. Due to the complex analysis of vibration testing, it is necessary to rely on a software platform that can effectively collect, store, process, and display data in real time. If every complex vibration tests analysis software programming starts from the most basic data acquisition software, the repetitive work is too much. Therefore, the author focuses on the design of the software general platform and pays attention to the generality and expansibility of the software and hardware of the system, in order to lay a foundation for the expansion of higher-level software functions in the future and avoid unnecessary repetitive work. The current development trend of software platforms is the design of general software platforms, with the development of computer technology and electronic technology, software platforms are increasingly being used in various fields of engineering practice. For example, some scholars have designed the software platform of the bridge safety optical fiber sensing technology detection system [19]. Some scholars apply the software platform to relay protection devices, etc [20]. This is also the direction of the author. It will seek a software platform design scheme with strong scalability, improve the utilization rate of existing modules and reduce duplication of work; innovatively design the software architecture and improve the secondary development capability of the software platform.

3. Methods

3.1. System Composition and Architecture Design. The dynamic signal acquisition and analysis system based on virtual instrument technology is divided into two parts: upper computer and the lower computer. The upper computer is composed of a computer and software, and the lower computer is composed of an acquisition board and a sensor or exciter. Among them, the software on the upper computer is written based on the LabVIEW visual programming language. The lower computer adopts the boards supported by LabVIEW, such as the boards 4431 and 9234 of NI

Company, and the sensors and vibration exciters used, such as PCB Company's hammer, acceleration sensor, and NTS Company's vibration exciter. The system composition is shown in Figure 1.

The software operation logic is shown in Figure 2. After the system starts, initialize the parameters and wait for the software to operate. Software operation causes program event response to complete data acquisition, waveform output, or data analysis functions. Among them, data acquisition and waveform output can only be used after completing the relevant parameter settings. The software can simultaneously run waveform output, data acquisition, and perform simple processing on the acquired data, such as fast Fourier transform (FFT), or frequency response functions. The data analysis shown in Figure 2 refers to high-level data analysis, such as modal frequency, modal mode shape, and modal damping identification from the frequency response function matrix; from the response information obtained from the data acquisition, the load imposed on the structure is obtained; the working modal analysis is carried out from the frequency response function matrix, etc.

3.2. Expansion Design and Implementation of Software Platform

3.2.1. Software Framework Based on Multitask Operation. The software adopts a large-scale multitask structure, with a total of 4 loops and 4 queues, which can process 4 tasks at the same time; it makes full use of the multicore and multithread performance of the existing computer CPU to meet the needs of actual experiments. If you need to add more synchronous multitasking, you can refer to the existing software framework and complete the software multitasking requirements by increasing the number of loops and queues. The specific software multitasking architecture is shown in Figure 3.

3.2.2. Activity Window Carrying Function Expansion. The software adopts a modular design, and many functional modules are encapsulated in subVIs. When these function modules are used the subVI is loaded through dynamic calls, and the front panel of the subVI will also be loaded into the active window of the main program. It is the existence of the active window that provides great convenience for software function expansion. In order for the software to comply with the logic of humanized operation, that is, to use the active window in a jumping and random manner, the operation logic of this part is shown in Figure 4.

The key is that when the next function subVI needs to be loaded, the previous function subVI must be forcibly closed through the main program, thereby, the operation rights of the active window are reclaimed. In addition, referring to the execution logic of Figure 4, it is convenient to use the active window to expand the function.

3.2.3. API Interface Reserved for Software Expansion. In order to facilitate the secondary development of the software, the software has developed a variety of

commonly used subVIs to facilitate users' call, such as the subVI output in standard time format, which is used for the naming of data acquisition files; the subVI for solving the frequency response function is used to solve the frequency response function of each channel for multi-channel data.

In addition to subVIs, the software also has more variables that can be used directly, such as the main panel tab, which is used to switch the display content of the main panel; the VI path, which is used to control the active window.

3.2.4. Hardware Universal Design. There are only a few acquisition boards in NI that support signal triggering, and when the data acquisition method is limited acquisition, signal triggering is often required, for example, when the frequency response function of the vibration response is measured by the hammer method, the rising edge signal trigger is required. In order to make the software platform more versatile, when the software is designed and implemented, using the method of real-time monitoring of the collected signal, when the signal reaches a certain level, trigger the acquisition and recording, and indirectly realize the signal trigger function. Therefore, when the board is used, the trigger performance of the board can be ignored, and the system can support more acquisition boards.

In addition, the software adopts a multi-channel design, natively supports 32-channel signal acquisition, and supports the acquisition of various sensor signals, such as acceleration, speed, and force sensors, etc., realizing the hardware universal design.

3.2.5. Frequency Domain Analysis. It is difficult to understand the vibration of the system directly from the collected time-domain vibration data, in order to understand the amplitude-frequency and phase-frequency characteristics of each harmonic component in the time-domain signal, it is necessary to perform spectrum analysis on the time-domain signal. Signal spectrum analysis is to use the Fourier transform to transform the time domain signal $x(t)$ into the frequency domain signal (f), so as to help people understand the characteristics of the signal from another angle. The Fourier transform of the time domain signal is

$$X(f) = \int_{-\infty}^{\infty} x(t)e^{-j2\pi ft} dt. \quad (1)$$

In the formula, $X(f)$ is the frequency domain representation of the signal; $x(t)$ is the time domain representation of the signal; f is the frequency.

Through spectrum analysis, the frequency components and structures of the signal can be understood, so that the operating state of the system can be revealed from the frequency information. To this end, as an important part of the software program, the frequency domain analysis module has the analysis functions of the unilateral amplitude spectrum and power spectrum of the data information. The front panel of the module has clear function indications, and

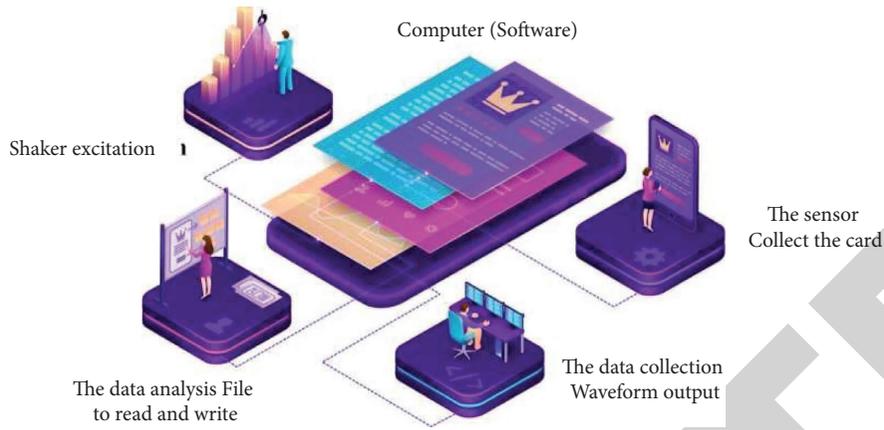


FIGURE 1: System composition and architecture.

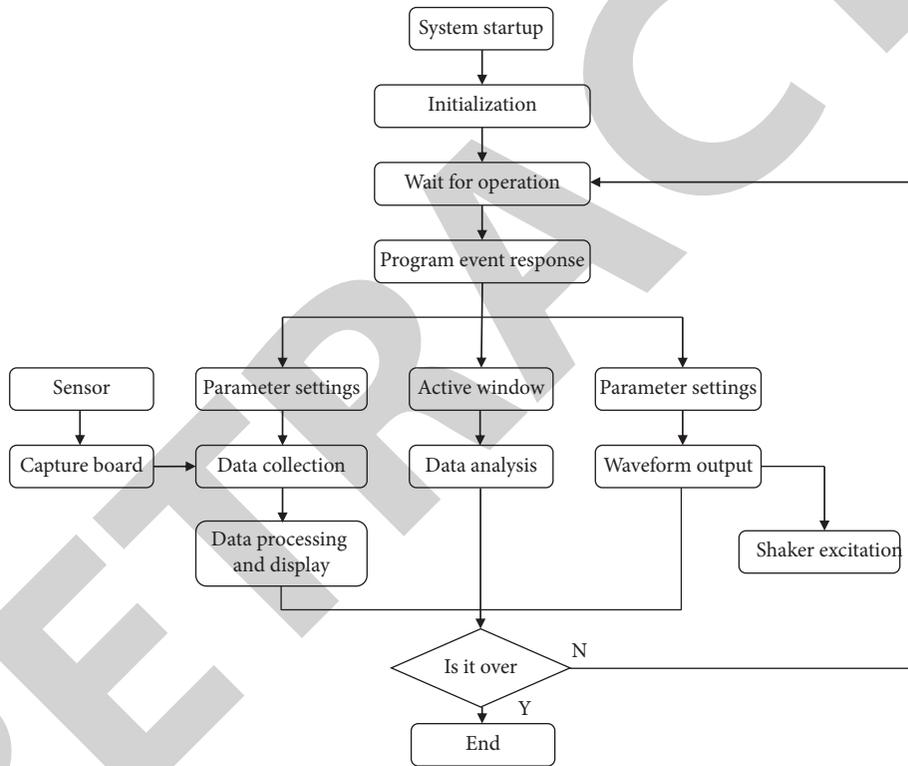


FIGURE 2: Software running logic.

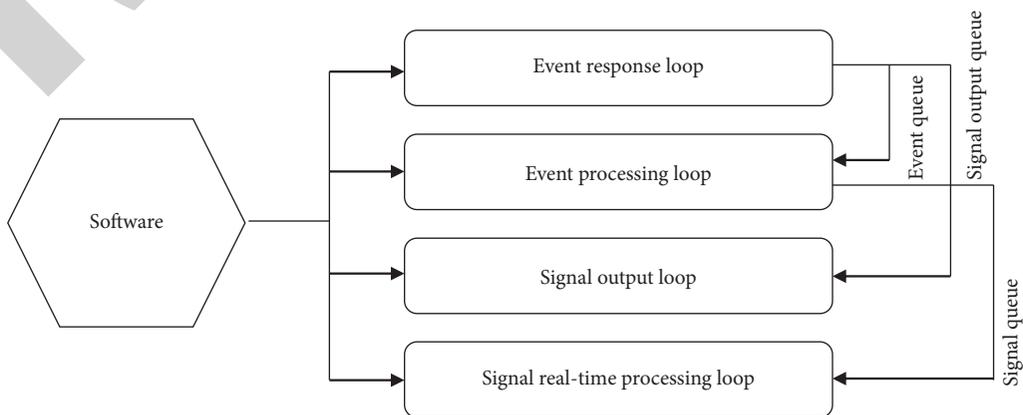


FIGURE 3: Multitasking framework of the software.

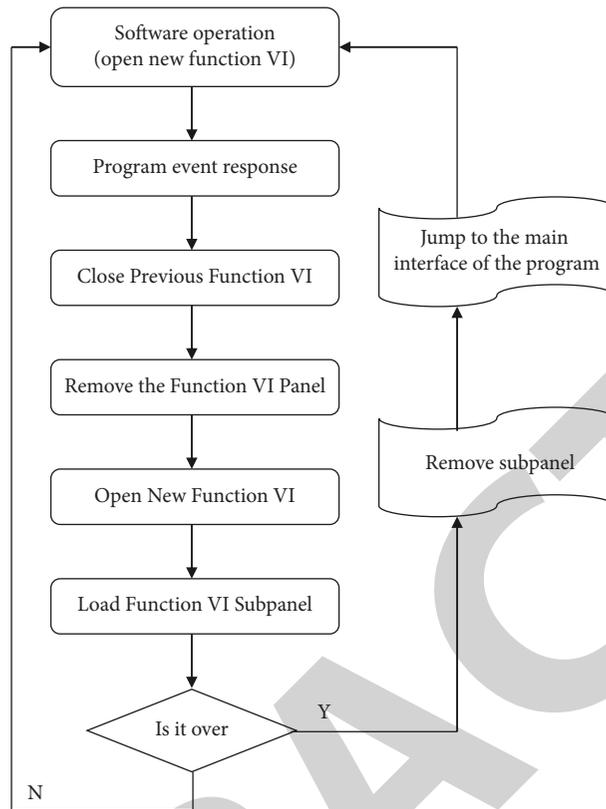


FIGURE 4: Operation logic of software activity window.

the application of subpanels is convenient to realize the delay-free switching of display panels under different functions with smooth operation performance. In the waveform display frame, not only can you count the maximum value according to the specified threshold and display the response extreme value, you can also set the knob button to specify the harmonic order, which makes it convenient to use the cursor to analyze the frequency multiplication information.

3.2.6. Time Domain Analysis. As the most basic functional module in data analysis, time domain analysis can combine the corresponding amplitude and time to display the data trend and trend. It is also for this reason that most of the existing analysis software has not carefully crafted every detail. Faced with this reality, the system focuses on building a time domain analysis module for dynamic test data, taking into account the characteristics of the dynamic system test data, such as many channels, large amplitude differences, wide fluctuation range, and long test time. A single-channel and multi-channel composite analysis framework is used, allowing complete channel or channel-to-channel data analysis according to usage requirements.

3.3. Examples of Software Development. Based on the abovementioned design, the detailed development of the software is carried out. The software adopts 4 loops and 4 queues as the underlying framework of the software, loop 1 is

the event response loop, and the software operation response is controlled in this loop; the second cycle is the event operation cycle, and most of the functions of the software are completed in this cycle; the third cycle is the waveform output cycle, which is used to control the waveform output to the exciter; cycle 4 is a real-time data processing cycle, including real-time processing of commonly used vibration test data such as FFT transformation and frequency response function solution. The software adopts a 32-channel design and supports the use of a variety of sensors. The software design adopts humanized design, and the software interface and the test setting process are designed according to the specific test demand process.

4. Results and Discussion

In order to verify the usability of the system, the system is compared with the smart office software of $m+p$ company, and the test is to obtain the frequency response function of the cantilever beam. The test results are shown in Figure 5 and Table 1.

It can be seen from Table 1 that there is no frequency error between this system and the smart office data acquisition system of the commercial software $m+p$ company. The amplitude error is less than 4%, which is within the allowable range of the test. The software platform of the system is available through experiments.

In addition, the secondary development was carried out with the software platform designed above, and the design and development of the distributed dynamic load

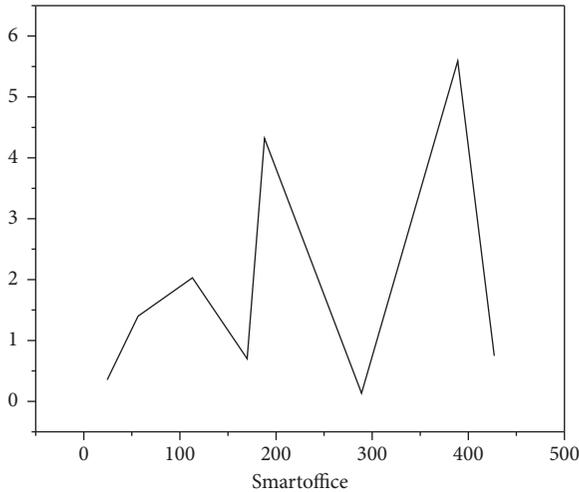


FIGURE 5: Comparison of test frequency response functions.

TABLE 1: Test frequency response function error.

		This system signalexpress		Error
Tier 1	Frequency/Hz	22.50	22.50	0%
	Amplitude/(g/N)	0.8792	0.8520	3.19%
Tier 2	Frequency/Hz	61.25	61.25	0%
	Amplitude/(g/N)	1.8895	1.8212	3.75%
Tier 3	Frequency/Hz	120.00	2.3678	0%
	Amplitude/(g/N)	120.00	2.3068	2.64%
Tier 4	Frequency/Hz	196.00	4.5743	0%
	Amplitude/(g/N)	196.00	4.4703	2.33%

identification system were completed. For details, see the design and implementation of the beam distributed dynamic load identification system based on LabVIEW. This case demonstrates the feasibility of the software platform described by the authors.

5. Conclusions

The author proposes the analysis and processing of software development data under the Internet of Things monitoring system and introduces the design of the software platform for the acquisition and analysis of vibration test data with strong expansibility. The system is formed by the combination of software and hardware, the software functions are reasonably set, and the software operation logic is determined. Through a software framework based on multitasking operations, lay the groundwork for simultaneous multitasking; through the design of the active window, it is easy to meet the needs of various function expansion; in order to facilitate the secondary development of the software, the API interface for software expansion is reserved; the software supports multi-channel data acquisition, realizes signal triggering by real-time monitoring of acquired signals, and realizes hardware support for more acquisition boards.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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