

Research and Application of Embedded Software Reliability

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Abstract: Embedded software has high reliability and security, and it has been applied in various fields of human life. How to build software reliability model according to its own characteristics has become a hot spot of current research. In this paper, the embedded software is taken as the research object, the software reliability is analyzed and discussed, and the software reliability model is established. Aiming at the closed-loop system of software, this paper constructs a system platform. In order to test its reliability better, cross-test method is used synthetically. It is hoped that it can be used as a reference for subsequent development.

1. Introduction

The reliability and security of embedded software are very high. Its inheritance and technological cohesion are stronger than other technologies, and its development is more stable. Therefore, it is gradually applied to various industries, mainly in aerospace, communications, finance and so on. Because of its reliability and safety, this technology has attracted wide attention. Recently, due to the development and change of the international situation and the global situation, the focus of national defense has gradually developed towards high-tech direction. Embedded technology has become more and more widely used in military enterprises. However, while enjoying the convenience brought by software, we need to realize that the reliability of software should also be concerned.

Although hardware design and testing can promote the rapid development of related industries and fields, the shortcomings in hardware also increase substantially^[4]. By contrast, the software industry is younger, and its theoretical and engineering applications are still in the initial stage of development. Therefore, there are many cases of software failure, and the consequences are more severe than those caused by hardware.

For data processing, when dealing with transactions, software is the most important issue, which is not only expensive but also unreliable^[5]. If the software is unreliable, it will lead to the failure of the system, and eventually bring catastrophic consequences^[6]. Therefore, it is urgent to study the reliability of the software. At the same time, it requires the software to implement quality management system, especially the adoption of standardized and scientific software model, so that the software enterprises can better produce high-quality products. The research on software reliability has both research value and application value. How to build the reliability model according to the characteristics of embedded system has become the focus of this paper.

2. Embedded software

The purpose of reliability testing of embedded software is to find some defects or errors in software. These tests are an important means to improve reliability. In the process of embedded software development, reliability testing is an important issue. For reliability, the requirements between embedded systems and non-embedded systems are also different. In important fields, the reliability of embedded system is far greater than that of non-embedded system, especially through more processing forms to ensure the reliability of software. If in software development, we usually continue to develop while researching and analyzing, in addition, we need to provide self-checking procedures, and constantly improve the testing of the system. If you want to ensure the reliability of the code, you usually consider using professionals for testing. At the same time, you should also

focus on training teams to ensure that the testing work is successfully completed.

At present, there are some problems in the test of embedded software^[8-10]. Most of them focus on several aspects: first, the reliability model of embedded software. Figure 1 shows the reliability model of the software. The purpose of this model is to obtain the required data, which requires that the software under test must run in the real environment to get real results. It is often difficult to simulate the required environment, so software testing often depends on testing before putting into the market, so it can only test its function after simulating the real environment. Secondly, it mainly discusses the requirements of embedded software for its test environment. Mainly for two aspects of the test. One is to separate the code and test it on the mathematic platform, while the other is to connect the hardware and software with the physical equipment to determine the closed-loop system and complete the test. From the above, we can see that no matter which method is adopted, software testing can be realized, but each has its own shortcomings. Finally, the automation of software is implemented. How to make it automatically complete a more reasonable test plan has become the focus of research on test technology.

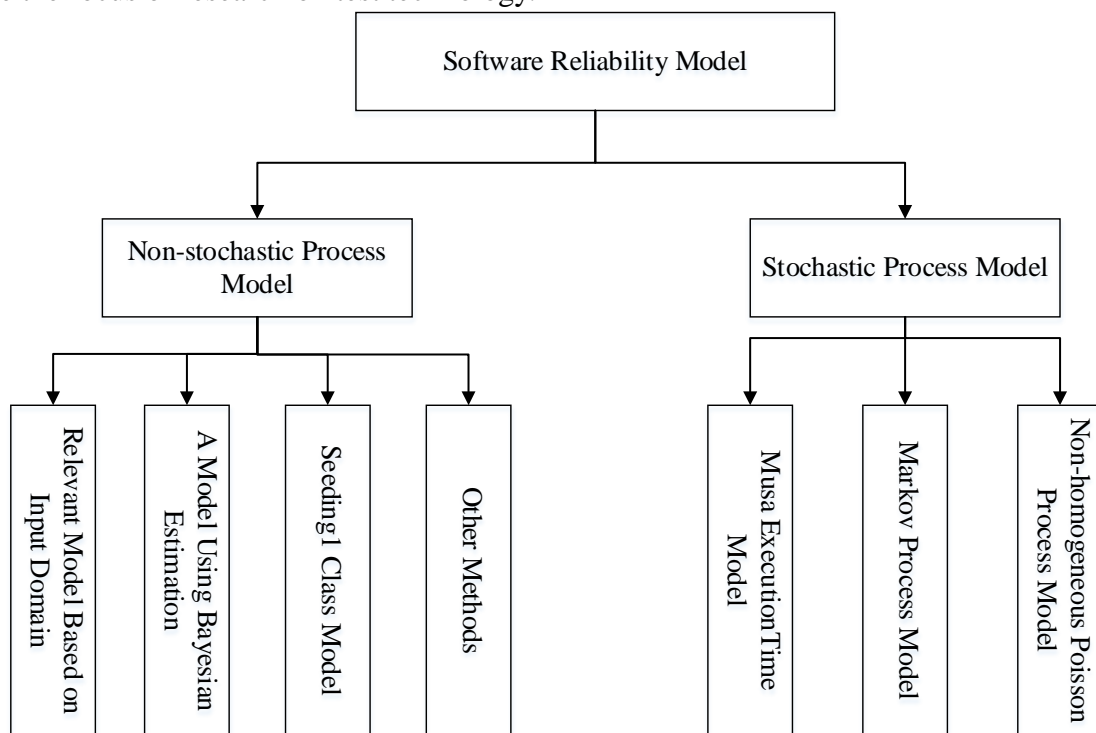


Figure 1 Software Reliability Model

The core purpose of embedded reliability testing is to verify or even ensure software reliability. The purpose of testing is to ensure its reliability. When compared with ordinary application software, embedded software has its unique characteristics and plays a special role. If it can run software in a specific environment, when inferring system failure, on the one hand, it should consider the output results, on the other hand, it should consider whether the results can be determined within a specified time. There are many things to consider, such as the state of input is also considered, in addition, whether the variables are correct, and the input in the prescribed range, which needs to highlight the advantages of building a closed-loop system. Figure 2 is a closed-loop system.

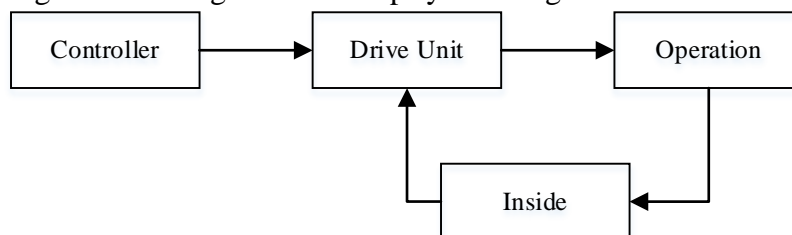


Figure 2 Closed-loop system

3. Software Reliability

The goal of software reliability is mainly to achieve the following objectives: first, to determine whether the functions of the software are realized. At the same time, the software requirements mainly include the following aspects, such as user requirements, business requirements, and functional requirements, including some non-functional requirements. Usually, the main function of business requirement is the preliminary benefit between customer and product developer, which can show the customer's requirement for product, and can be expressed in more detail in the project. The user requirement mainly depends on the document to explain and explain it further. For the function requirement, the purpose is to mark the software function that the developer needs to realize and complete the user's assignment. Business to ensure the dynamic needs of business. Secondly, it is necessary to verify the software reliability. When some requirements are met, the most important thing is to verify the software reliability after analyzing the software reliability model and observing the failure. Thirdly, it is the level of evaluation and prediction of reliability. When testing, it is necessary to observe whether there are data defects. Through field analysis and research of its data, after preliminary estimation of its reliability level, it is expected that its level can provide a basis for better decision-making for developers.

If reliability fails, its functional requirements will be affected. Based on the need of software reliability and understand its structure or how to achieve it. At present, it is an era of information technology, and the general trend extends to every corner of the world. Embedded systems impact the way of life of human beings, and the development of embedded systems also affects the way of thinking. So, the system also needs to be in line with the times from the perspective of development, and its process needs to be informationized and digitized. Combining with the platform, the compatibility is strong. Figure 3 shows the system principle.

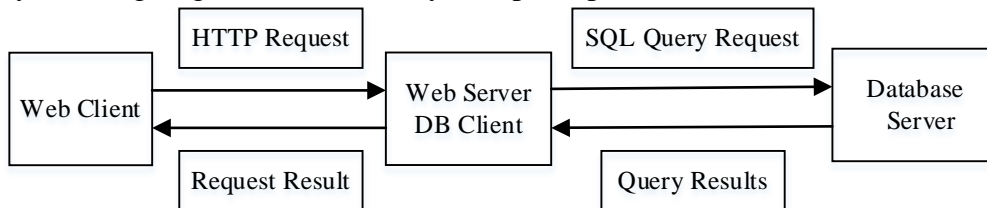


Figure 3 Systematic Principle

The outstanding advantage of embedded software and other software lies in its real-time performance. The main purpose of this feature is to consider the execution of the software. When the embedded software is completed, some constraints on the time conditions are often put forward. Usually, cross-testing is more common, accurate, real and simple. Figure 4 shows the method of cross-testing.

The usual step of cross-testing is to write test code on the host, then compile the code, download it to the target machine, and then execute the test code according to the test results. Because the testing tool is on the host computer, the testing information is usually on the target computer. When the host communicates with the target computer, the information obtained from the test will be transmitted to the host computer. When the host interface is used, the test results are compared and analyzed, usually relying on the analysis tool to analyze the relevant information, and the cross-test is true. Therefore, embedded software is usually used to build simulation platform to complete the test. Usually the platform is connected with the embedded software and test system under test.

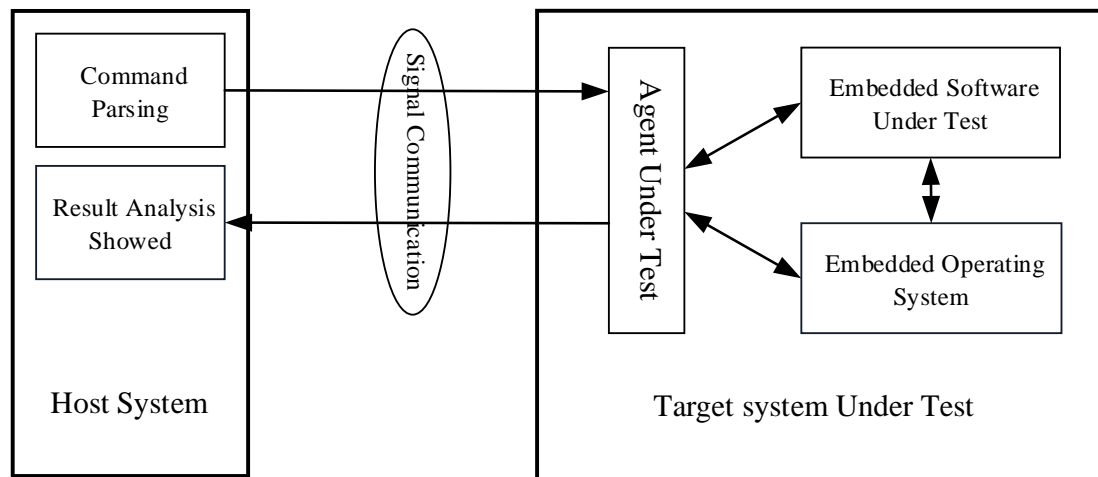


Figure 4 Cross-test structure

4. Conclusion

Software is the most important tool for data processing. If the software is unreliable, it will lead to system failure and eventually bring catastrophic consequences. In this paper, the research of software reliability is studied. According to the characteristics of embedded system, the reliability model is established. In order to better test the reliability of embedded software, this paper comprehensively uses cross-test method, hoping to guide the follow-up research.

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