A Highly Portable Solution for MWD Data Remote Transmission

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Abstract. The remote transmission of drilling information is the development trend of modern drilling wells. However, due to historical reasons, the early MWD in China generally did not have the remote transmission function, or did not support the standard WITS protocol remote transmission function. Because of the number of such MWDs is large, the price of MWD is expensive, and the stability of the performance, ease of maintenance of MWD, now MWD is still in large use, so it is necessary to develop MWD remote transmission functions in order to make full use of these large amounts of MWD resources. However, because there are so many different domestic MWD brand models, and their decoding software is also different, and some of the early software development did not consider the remote design, so how to find a general and simple solution, to achieve the MWD remote transmission function, in order to make full use of MWD resources, has a realistic significance.

After carefully studying the existing various MWD data characteristics, this paper designs a common WITS remote transmission solution for the data storage structure of MWD, which is based on the data storage structure of MWD, and the storage mechanism. With this solution, the innovative data from the database is read and converted to the WITS format, using the TCP/IP protocol and the Serial Port protocol to send. Because this scheme reads data directly from the database file, it avoids communication restrictions with The MWD software and has a strong portability.

Using this solution, The WITS function was developed for HL-MWD and tested in the actual drilling. The results show that the solution is stable and feasible, portability is strong, has universal reference significance for other similar MWDs, and can be developed quickly on the basis of this solution for other MWDs.

1. Foreword
Because of the remote transmission has advantages of convenience, fast, and large amount of information, it is very important to the digital construction of oil fields, and is also the development trend of modern drilling. At present, remote transmission has been widely used in MWD operations, because of the remote transmission applications, so that production management and decision makers can get a large number of real-time data information from the Internet in a timely manner, and monitor the operation of various potential risks together with the wellsite operators, and greatly improves the technical management capacity. However, there are still a large number of early MWD and even LWD, due to early design, does not have WITS remote transmission function. It seriously restricts the information construction of wellsite. In the market of Peru, HL-MWD belongs to this kind of situation, due to early design defects, it does not have the function of remote transmission, can not meet the Client information operation requirements. However, because of the stable performance, easy to repair, low cost of use of HL-MWD, it still has a great value to be used,
but according to Client's requirements, its lack of remote transmission function problem urgently needs to be resolved.

2. Design of Remote Transmission Solution

2.1 Selection of Transfer Data Format
The data transfer format for the remote transmission scheme is in the WITS standard format. The WITS protocol standard, the well-field information transmission specification, is a communication format that is used to transmit a wide variety of wellfield data from one computer system to another. In the field of exploration and development of the petroleum industry, it serves as a recommended format for operations and service companies to exchange data both online and in batch delivery. WITS data standard covers almost all of the data information related to well site.

2.2 Selection of Transfer Mode
The data transfer method for the remote transmission scheme is to use the TCP/IP protocol for transmission. TCP/IP transport protocol, include transport control/network protocol, is also known as network communication protocol. It is the most basic communication protocol in the use of the network.[5] Because of its high reliability, it is widely used in network transmission. TCP/IP transmission protocols define the standards and methods for communicating in various parts of the Internet. Moreover, TCP/IP transmission protocol is two important protocols to ensure the timely and complete transmission of network data information.[6] TCP/IP transport protocol is strictly a four-tier architecture that includes the application, transport, network, and data link layers. Its structure is like the Figure 1.[7]

![Figure 1. TCP/IP Transport Protocol Schematic](image_url)

2.3 System Design
Based on the above scenarios, a WITS remote transmission system for HL-MWD was developed.
2.3.1 The choice of design platform
The software is developed in the Visual Studio's C#.NET language. This language is designed in an object-oriented manner. It has good human-computer interactivity and portability.

2.3.2 Design process
With observational analysis, even different MWD’s software is different, but all the data is stored in a database file. If we want to make the scenario versatile and get rid of the problem that different software decoding software is not common and the data interface is not uniform, we can take advantage of the commonality of these MWD devices by reading the database file, converting it to WITS format, and then sending it with the TCP/IP protocol. The main design processes are as follows:

![Flow Chart](image)

Figure 2. MWD Data remote transmission Flow Chart

2.3.3 System functions
At present, the software sets the scanning interval of the database as 5 seconds, it has TCP/IP and serial communication two remote transmission way, and alarm can be achieved in the case of broken connection. To make the most of the resources, the software uses multithreaded development techniques. In order to verify the performance of the software,
the utility of CPU and memory of the software was also tested (as shown in Figure 3, Figure 4), the result showed that the CPU and memory consumption were low and it runs stably.

![Figure 3. The test of CPU’s utility](image1)

![Figure 4. The test of memory’s utility](image2)

3. Application
To verify the feasibility of a solution to read data from the database for remote transmission, the software was tested in the following wells: Sand H107/Ray 63-1, and the Koule C-11 wells which were drilled with HL-MWD. The result shows that, the number of the data record that send by this software is the same as the one that decoded, so there is no data loss during the remote transmission, and the delay of data transmission is within 5 seconds, which can meet the client’s operational requirement, so the solution is feasible. Also, because MWD generally uses database storage of real-time data, the solution is highly portable to other MWD devices.

4. Conclusion
(1) Because now in the domestic there are a large number of different models of MWD which have no remote transmission function, after studying the MWD data storage mechanism and commonalities, this paper provides a scheme by regularly scanning the database data to achieve MWD remote transmission function.
(2) Based on this scheme, we designed the HL-MWD remote transmission system, the remote transmission delay is within 5 seconds, the CPU and memory occupancy utility rate is low, which can fully meet the wellsite operation needs, and solves the problem of HL-MWD’s lacking of remote transmission function.
(3) Due to the versatility and portability of this scheme, a remote transmission system for different MWD instruments can be developed quickly, thus realizing the reuse of a large number of old MWD instruments that are available in China.

5. References
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