Abstract

In recent years, with the rapid growth of the global population and the continuous destruction of freshwater resources by human activities, the shortage of fresh water has become an important factor affecting the sustainable development of humankind. There are nearly 2 billion people in the world still lacking freshwater resources. In China, the issue of shortage of freshwater resources is not optimistic. China's per capita freshwater possession is still less than 30 percent of the world average. While the sea is rich in water resources on the earth, the use of seawater desalination systems to convert large quantities of seawater into freshwater for human consumption will undoubtedly greatly alleviate the shortage of freshwater resources.

The "Data and Protocol Analysis and Forwarding Software for Seawater Desalination System Equipment" design in this study can be used to monitor and relay equipment data for seawater desalination systems. It can help operators to easily observe the operating parameters of equipment of the seawater desalination system at the industrial computer (IPC) graphical user interface (GUI) or backend server database to maintain the normal operation of the seawater desalination system. For this goal, this project intends to design desktop application software that can analyze, display and forward related data on IPC. This software analyzes the network packet data transmitted between the equipment (such as wind turbines, battery management systems, AC and DC energy control devices, reverse osmosis desalination equipment) and the IPC according to the relevant protocols based on the actual situation and needs of the seawater desalination system. And the operating parameters extracted from the useful data analyzed from network packets are dynamically displayed through the software's GUI. In the meantime, these data can be forwarded to the backend server database by the software according to actual needs. Therefore, it would be possible to monitor the operating status of seawater desalination equipment remotely.

The application uses Python 3.6 programming to analyze the PCAPNG Wireshark network packet data file, which can be selected by the user in the software interface, by network protocol analysis to obtain various valid parameters and then takes advantage of the QML language combined with the Qt Quick module to design the graphical user interface, which is integrated with the data analysis program through PyQt5 to show the extracted parameters in GUI dynamically. At the same time, the application is connected to the already-established equipment database in the backend server of MySQL 5.7.9 through the pymysql module for inserting the valid parameters from the analyzed data into the corresponding tables in the MySQL server database according to actual needs. The software is easy to use and can efficiently analyze the data of each device of the seawater desalination system to obtain valid parameters and display them in the graphical user interface dynamically in real-time. It can also accurately complete the work of forwarding analyzed data to the backend server database. This software

program provides strong support for the work of monitoring and maintaining the equipment of the seawater desalination system, which can effectively improve the working efficiency of operators and help the whole desalination system continue to work normally.