

The Study on the Neutral Current Monitoring System of Distribution Network

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Keywords: distribution network neutral line; Internet of things; hub open sharing; early warning platform; server terminal

Abstract: Through the application of information technology and intelligent technology in the ubiquitous power Internet of things, a neutral current warning platform based on the Internet of things is built. This paper discusses the principle and composition of the platform, and briefly explains the relationship between the perception layer, network layer, platform layer and application layer. Through the use of the distribution network neutral current early warning platform, ensure the normal operation of equipment, the neutral wire connect and disconnect detection can be achieved. The neutral wire equipment failure resulted from abnormal operation can be avoided, at the same time, the neutral line running anomaly caused by equipment failure and disputes between the user and power supply enterprise can be effectively avoided. It has the good economic efficiency and social benefits.

1. Introduction

The government work report of 2019 proposed to build an industrial Internet platform, expand "intelligence plus", and enable the transformation and upgrading of manufacturing. The extensive application of big data, cloud computing, Internet of things, mobile Internet, artificial intelligence, block chain, edge computing and other information technology and intelligent technology in the power Internet belongs to the category of industrial Internet. It is the inevitable outcome of the rapid development of the digital revolution in the field of energy and power. At the same time, the state grid corporation of China has put forward the strategic goal of "three-type, two-network, world-class". The company's ubiquitous electric power Internet of things construction deployment video teleconference proposed that the construction of ubiquitous electric power Internet of things is an important content and key link to promote the "three type and two networks" construction.

According to the concept of ubiquitous power Internet of things proposed by state grid corporation, Jianfeng society staff innovation studio of Fushun power supply company aims to improve the intelligence level of distribution network, ensure the strength of power grid, improve customer satisfaction and achieve lean operation management. By using Internet of things technology to build an industrial ecological platform of "hub open sharing" and power distribution (energy consumption), power grid operation and deep perception of core equipment status will be completed, power grid fault predictability will be enhanced, and maintenance mode will be changed from "passive service" to "proactive prediction".

2. Original problem

Due to three-phase load imbalance, single-phase ground fault, neutral line break and other reasons, low voltage distribution network (380v) will produce a large voltage and current, which make the equipment can not run normally, seriously lead to the user electrical equipment damage, resulting in frequent claims disputes between the user and the power supply company.

At present, the neutral line of the distribution network is not equipped with a current monitoring system. Therefore, in order to ensure the normal operation of the equipment and avoid equipment failure caused by the abnormal operation of the neutral line, a neutral line current warning platform based on the Internet of things is developed to monitor and warn the neutral line current.

3. The whole framework

3.1. The perception layer

In order to find the changes of the voltage and current parameters at the neutral point of the transformer in time, the construction of the sensing layer needs to be carried out. It is planned to use the coupling clamp, coupling coil and other mutual inductance equipment to collect the signal, so as to facilitate the next analysis.

3.2. The network layer

The company's main network, fiber optic network, 4G, 5G network, etc. are utilized to meet the overall requirements of high real-time, high bandwidth and full coverage, and the perception data information collected by the perception layer is transmitted to the platform layer.

3.3. The platform layer

Relying on the power supply service command system and the unified data center of the whole business, the data of the terminal device of the perception layer is uniformly stored, and the structured and unstructured data collected or processed by the perception layer and uploaded and measured data are collected, integrated and utilized.

3.4. The application layer

The data results of platform layer analysis are fed back to a series of terminal devices such as handheld computer and mobile phone APP, so as to achieve the purpose of timely warning and prompt repair.

4. Development process

This warning platform to distribution transformer monitoring unit of area division of management, using open jewels current transformer (roche coil principle) on their area of a single transformer neutral current for monitoring all the way. According to the size of the transformer capacity set transformer neutral current alarm threshold, which can be timed transfer management area of a single transformer neutral current to the recording, summarizing, generate time management background current trend diagram. It can also be used in real time by the background reading current, according to the operation of the transformer neutral current maximum allowed set alarm, and has applied for the data access to the national grid data center. The data platform of the state grid is directly transmitted to the mobile phone terminal of the management personnel of the station area by SMS or WeChat, so as to adjust and deal with potential accidents such as three-phase unbalance in a timely manner. The monitoring data will be transmitted to the server terminal by each management station unit, and the neutral line current of transformer in the whole distribution station area will be recorded, and the summary report will be generated.

Taking the management station area as a unit, each test point of the transformer in the station area is composed of a network of cloud servers. The neutral line current change database of each transformer in the station area is established. Connect the PC server through the network of data records of each network area, conduct the database of all monitoring data, summarize and generate reports.

1) Current acquisition and transmission module of distribution platform area: Including open current transformer, 220V power supply and measurement conversion module, Internet of things communication module.

2) Management platform area Internet of things data recording unit: Receive the current transmission of transformers corresponding to the management desk area (up to 64), record and generate the trend chart. Set the alarm value according to the alarm value.

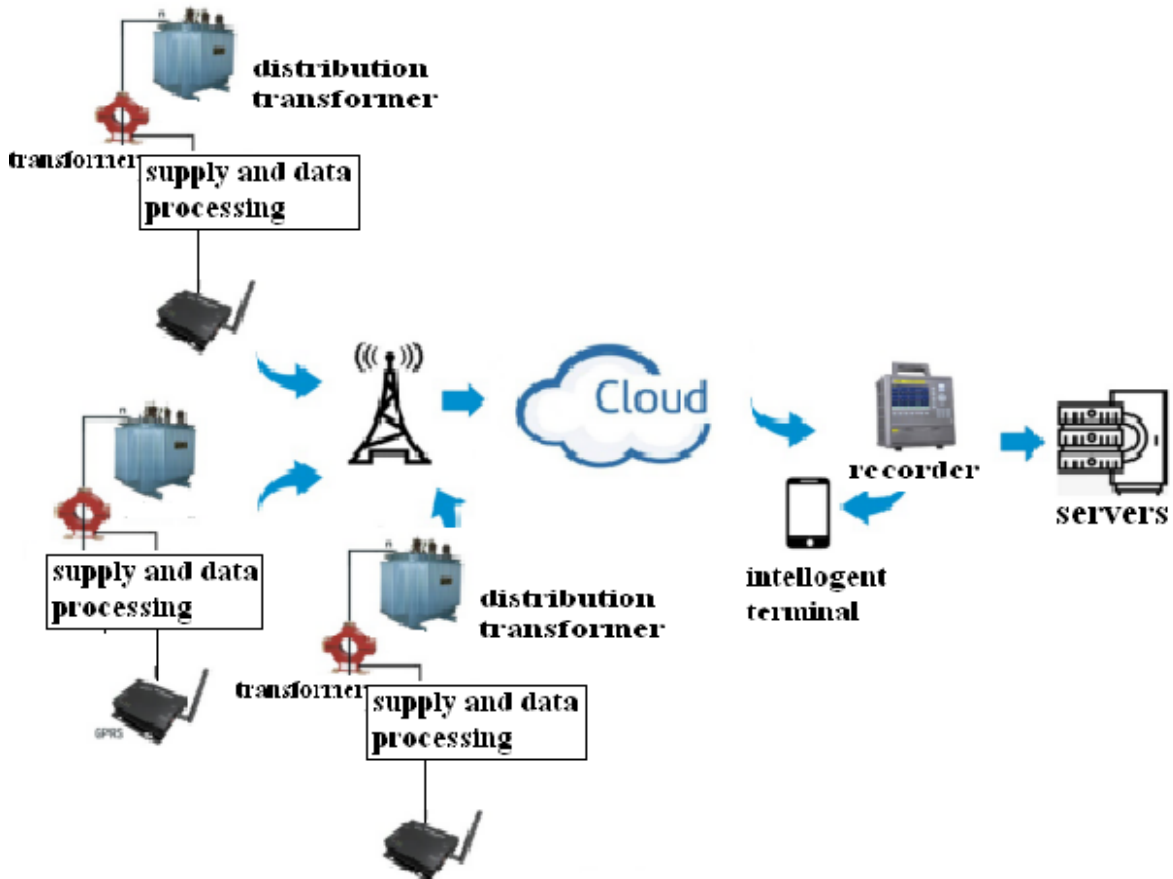


Fig.1 Neutral current warning platform of distribution network

5. Technical characteristics

1) To ensure the normal operation of the equipment, virtual connection and broken line detection of neutral line can be realized, and equipment failure caused by abnormal neutral line operation will not occur;

2) It has high sensitivity, accurate reliable, and correct alarm.

3) To reduce disputes between users and power supply enterprises caused by equipment damage

4) To reduce inspection time and manpower input in low voltage area

5) During installation and disassembly of the device, the transformer does not need power off. The built-in power supply covers a small area. Installation and disassembly are simple and convenient.

6) It can collect the current situation of neutral line of transformer in real time, and send the data and location of the station area to the management background through wireless transmission to record, summarize and generate the trend chart of time current change

7) Set the warning value, send the warning information to the operation and maintenance personnel in time, do a good job of proactive prediction, can eliminate hidden dangers in advance.

6. The working flow of the device

Open jewels card on the neutral line current transformer, transformer range for 100A (or 200A), through the transformer of the neutral current signal sampling, and through signal amplifying, filtering processing, modulus conversion to transmit a discrete sampling points to MCU.MCU by DSP operation from current amplitude transmitted iot module test data, the sampling data recorder through transmission module on the set time.

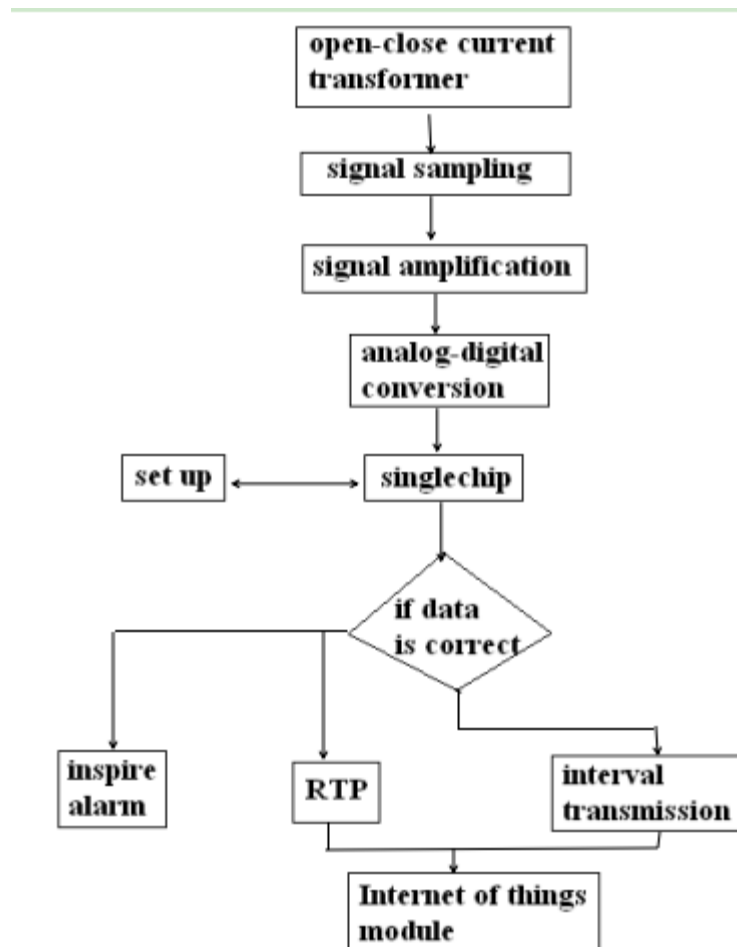


Fig.2

After the data sent by each monitoring device in the unit recorder receiving station, the data will be preliminarily processed. When the test data is abnormal, the data will be sent to the manager's mobile terminal and the recorder at the same time. Mobile terminal through the way of vibration, rang the bell, the screen prompt told abnormal change and abnormal data. When the test data is normal, data transmission to the chart recorder to record test data and generate the intuitive, have test data export function. A period time of the test data can be exported to excel spreadsheets, which facilitate subsequent reference and records.

7. Field application

The current warning platform of neutral line of distribution network is applied to the neutral line of No. 3 transformer brought by No. 1 ring network cabinet in Dongfang community in Fushun. The specific process is as follows.

No.25-3 floor people activity center community activities at 6 PM, all nearby residents to come, and the activity center of power supply by No. 3 transformer. The A phase is the supply phase, which change the load by BC two-phase. So the load by A phase suddenly increases, the BC suddenly decreases, and two phase load caused by neutral current of No. 3 transformer I_e is more than 20% of the design value, actual value is 22.5%. The alarm unit turn to yellow lights, but as the activities to gather more and more, Various activities carried out gradually, the power consumption is larger, the neutral current I_e increased from 22.5% to 27.6%. I_e distribution network neutral line over-current alarm sound and light alarm unit turns red, send out alarm at the same time, the neutral current reached 31.6% I_e distribution network neutral line over-current alarm sound and light alarm unit lights bright. At this point, the mobile terminal of distribution management tips this equipment abnormal change and abnormal data, and immediately sent distribution emergency workers rushed to the scene. Workers rushed to the scene in about 10 minutes to work on the neutral displacement

voltage disposal, to exclude hidden trouble. A power distribution equipment accident caused by excessive neutral current is avoided.

8. Conclusions

At present, the neutral line of distribution network is not equipped with current monitoring system. At the same time, the team searched for new devices on such platforms as cnki and national patent network, but found no similar devices. This platform can effectively avoid equipment failure caused by abnormal neutral line operation and disputes between users and power supply enterprises, and has good economic and social benefits. Meanwhile, it can save time for maintenance personnel to find problems, realize proactive prediction instead of passive service, and solve safety hidden dangers in advance. At the same time, this platform can collect transformer neutral current data in real time and form reports and trend charts, so as to realize information interconnection between power system and equipment and effectively promote the construction of ubiquitous power Internet of things. Therefore, this device has a broad market prospect and good promotion value.

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