The Research and Development of Coal IoT Reasoning Engine Based on XML Model

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Abstract: On the basis of analyzing the coal IoT data requirements, we have proposed a reasoning engine based on XML rule model. We made a unified rule model for the IoT usual scenarios and policies according to the XML language. Also we have introduced the rule management mechanism to manage the objects and adapt to the changeable environments. Finally we have designed and implemented the reasoning engine based on the XML rule model.

Keywords   一Internet of Things Reasoning XML

The Internet of things "Internet of things" (IoT) is an important part of a new generation of information technology, IoT at the same time can also be understood as "connected to the Internet". The Internet of things (IoT) can be defined as by radio tags (RFID), infrared sensors, global positioning system (GPS), such as the laser scanner information sensing device, according to the contract agreement, connect any item with the Internet, information exchange and communication, in order to realize intelligent identification, location, tracking and monitoring and management of a network [1]. At present, the Internet of things technology has large-scale application in coal mine industry, such as mine location, equipment management, wireless communication, etc. In the coal iot, mass, complexity and heterogeneity are the main characteristics of the three prominent [2].

According to the above analysis, the coal strategy inference engine of the Internet of things needs to be implicit knowledge is obtained from the given data, basically is to define implicit in explicit and the high-level information through a processing mechanism in the statement. Iot system of coal mine based on the intelligent reasoning engine, can form the data center, may be called at any time according to obtain the huge amounts of data for decision making and management support [3]. In this paper, based on the XML rule model, and puts forward the event-driven inference engine architecture. Model based on architecture design and rules implemented XML based strategy model of coal mine Internet of things intelligent inference engine.

Ⅰ. COAL MINE NETWORK INFERENCE ENGINE DEMAND ANALYSIS

Under the environment of coal mine Internet of things intelligent inference engine over traditional inference engine has the following new requirements[4,5]:

1) For real-time events: intelligent reasoning input events must be active, real time trigger, and thus drive equipment to provide users with coal mine Internet of things services.

2) Dynamic data information: in the coal mine environment contains the rich Internet data; Information sensing device, according to certain frequency to receive data.

3) Real-time reasoning results: coal mine workers need to get the data, and enjoy mine Internet of things services actively, make decisions more easily and management.

4) Inference model generality: coal mine Internet of things intelligent reasoning engine needs to language knowledge was described, convenient between system and system calls and sharing.

Scenario based on reasoning strategy and the demand of the above analysis, reasoning scene in the coal mine Internet of things is mainly boils down to safety management and control of the two[6]. The former mainly includes authentication, authorization, and audit three application scenarios; Which need data to make dynamic changes to the change of environment, so we need according to user requirements for effective dynamic adaptive correction. And strategy is derived by the management demand, relative lasting, illustrative some kind of behavior is used to control the system rule, this rule constraint system to make a decision process[7]. From strategy to consider the nature of, also can be divided into security policy and control strategy. Reasoning method based on the strategy refers to the inference system according to the set in advance good strategy, to implement information access, information and equipment monitoring and configuration, provides the user the required services.

In this paper, the strategy model IXML model is adopted to improve the unified expression. Its role is to define the legal components of an XML document, in view of the coal mine environment data content can be extended; And supports data types and namespaces, so the XML Schema in most of the Internet of things applications are widely used in the scene[8]; It also makes the coal iot system based on Web in the exchange of XML data is more convenient and quick.

Ⅱ.THE RULE MODEL BASED ON XML LANGUAGE IXML

Coal mine Internet of things intelligent strategy inference engine is the core idea of the input of the real-time iot into matching conditions in the premise of production rules, then the facts and logical comparison

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operation data and expectations, and deduces the conclusion part of the production rules established [9]. This article USES IXML policy model to define the rules. IXML model has good ability of semantic, convenient user configuration independently; Have the characteristics of object oriented environment at the same time, so can carry on the good combination and object-oriented programming. Rule is composed of Condition and Action. System to evaluate Condition, if the evaluation result is True, then the rule engine will launch one or more Action. Format is as follows:

If condition Do action

Condition is applied to the facts of one or more predicates of True/False Boolean expressions. The Action is to evaluate the Condition of functional outcome. If meet a rule Condition, be in namely and only in the Condition is True when the execution will launch the corresponding Action. IXML strategy context includes the following four: 1) RuleFactory set, contains the rule of the solution, can be the default, also can be customized. 2) Operator set, contains available comparison operators, such as: = =, <, >, etc. 3) the Result set, contains the initial Result and user data. 4) CallStack (stack), can add the Result Result concentration at the same time also is added to the callback mechanism.

Instances of IXML strategy is given below mine iot control scenario syntax examples. If the current mine (30 °) when temperature is greater than the threshold method, the system will then determine humidity: if the humidity is more than 60% in mine, shows the message "Wet&Hot".

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- global values -->
<Integer id="60i" value="60"/>
<ObjectLookup                    id="HumidityLevel"
objectId="CurrentEnvironment" member="Environment"/>
<Logic>
<If>
<And>
<GreaterThanEqualTo            leftId="Temperature"
rightId="TemperatureThreshold">
<ObjectLookup                     id="Temperature"
objectId="CurrentEnvironment" member="Temperature"/>
<String id="TemperatureThreshold" value="30"/>
</GreaterThanEqualTo>
</And>
<Do><Logic>
<If>
<And>
<GreaterThan leftId="HumidityLevel" rightId="60i"/>
</And>
<Do>
<Evaluate id="AppliedMessage">
<Parameter name="Status" value="Wet&Hot"/>
</Evaluate></Do>
```

</xIoTRules>

III. COAL MINE INTERNET OF THINGS INTELLIGENT INFERENCE ENGINE DESIGN

According to the demand analysis in section 1 and section 2 IXML model, in this paper, the coal mine Internet of things intelligent inference engine design. Rules of inference engine through the interface engines write customized adapter and binding business objects, can be very easily expanded. Coal mine Internet of things intelligent inference engine module as shown in figure 1:

(1) the rules of load modules: the original rules of coal mining in the Internet of things system description into NxBRE input can handle xbre format rules document. Mainly USES the XML parsing technology, discriminant conditions will be used to describe the scene in the program data structure mapping rules documents into a specified format.

(2) the condition data acquisition module: application in coal mine Internet of things "conditions" in the system, referring to the sensing layer of sensor data collected from the system, including temperature, humidity, illumination, concentration of toxic gas and so on. By real-time and distributed characteristics of coal mine Internet of things system, demand conditions in real time data needs to be a long time, with distributed process at a time to collect a number of sensors.

(3) data input module, data acquisition module was URL - resources numerical key/value pair, need according to the process engine handles the structure of the complete collection of data and input conditions adaptation transformation work, and numerical concrete filling process engine in the data structure of the input data.
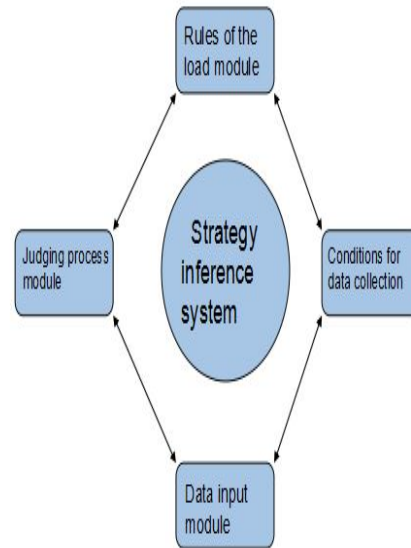

Figure 1. Inference engine module

Ⅳ IOT INTELLIGENT INFERENCE ENGINE PROTOTYPE IMPLEMENTATION

A   The working process of the inference engine

Inference engine based on iot of coal mine system prototype for the actual business processes through business rules engine is bound to the application, need to undertake the following seven steps:

1,Establish business rules based on IXML describing documents;

2, Create business rules engine process object;

3, The process engine load or replace business rule sets, implementation is based on XML document parsing;

4, Submit to the engine need to be processed data collection of objects (coal mine environmental data input);

5 And process execution engine, based on the analytical results IXML than input conditions;

6, Export engine perform data results;

7,The above business rules generated modules encapsulated into the user interface.

B.Business rules based on xBRE document generation

In this paper, section 2 of xbre document is loaded in iot system of coal mine actual example of business rules. Business rules documents need to increase the number of conditions and logic branch by design personnel, and the input conditions (greater than, less than, etc.), variable names and threshold, to complete logic branch under the policy Settings.

C.Conditions for the realization of the data acquisition module

This system acquisition module by polling mechanism, interval time take turns to visit a gateway access Internet of things in coal mine system under several sensor data, as a condition data, dormancy. After completing. Polling is implemented by ScenarioPollingBLL class (S.P.), which is responsible for loading scenarios, China open closed sensor data read coal mine environment, and input into a scene. The polling process of pseudo code is shown below:

While（true）{Load all configuration scenarios, into members LoadedScenarios S.P.;

If: load the scene

{For recorded in each scenario, which in turn：

{Read the scenario each condition in the corresponding value of the sensing device to ReadResultList;}

Will ReadResultList numerical key value pairs into the sensory NxBRE engine acceptable input format；}}

Dormant for a period of time；

}Rules of the load module

D NxBRE rules engine load module

The load module by constructing ReadRule class object initializes the object, from the rules file into the business rules; In addition, ReadRule object also provides a concrete class from the program in the deserialization and get ReadRule interface from the Web URL. After initialization ReadRule object, need to set the rules of object references, through the c # reflection technology[11], the generation to a specific class at runtime. Examples are shown in figure 2 below system interaction effect, rules of inference engine and the results will be control, logical and numerical approach is presented to the user.
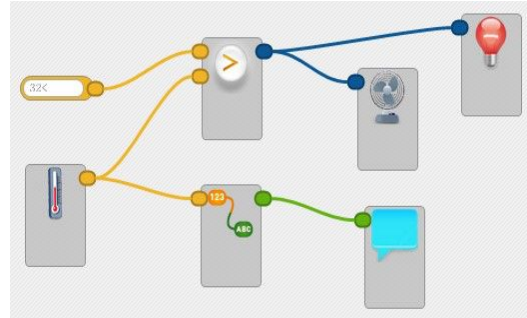

Figure 2. System interaction diagram

Ⅴ CONCLUSION

In this paper, according to the actual demand for coal mine Internet of things, designed can meet the demand of coal mine Internet of things system application scenario rule engine application system. Configuration of the system can detect IXML strategy, condition of data automatic collection, input matching rules and conditions, the final judgment result by calling the reasoning engine output of coal mine scene, judgment for coal mine Internet of things application strategy scenario provides a strong support. Finally, this paper implemented to verify the mine network inference system prototype.

REFERENCE

[1] Gao-Chenguang.The Internet of things application in the field of coal supplies [J]. Enterprise reform and management2012,07:38-39.

[2] Kong-Ning. Internet resources addressing key technology research[D].Graduate school of Chinese academy of sciences (computer network information center),2008.

[3] Wan-Jianchen,Fu-Hui.The coal equipment warehouse management system based on Internet of things

technology   application   research[J].Coal technology ,2013,05:280-282.

[4] Shen-Subin,Mao-Yanqin.Iot concept model and system structure[J].Journal of NanJing university of posts and telecommunications (natural science edition),2010,30(4): 1-8

[5] Xi-Jinjin,Ding-Enjie.The design and implementation of a coal mine in the Internet of things intelligent terminal[J].Electronic   technology applications,2012,38(12):77-79,86.

[6] Wang-Yanjiong. Some security problems in Internet research and application[D].Beijing university of posts and telecommunications,2011.

[7] Nie-Yuanming,Zhang-Hongjun.The Internet of things security   level   protection   strategy research[J].Information   network security,2011,(6):20-21,32.

[8] He-Ming,Chen-Guohua.Under the environment of Internet of things cloud data storage security and privacy protection strategy research[J].Computer science,2012,39(5):62-65,90.

[9] Kortuem G, Kawsar F, Fitton D, et al. Smart objects as building blocks for the internet of things[J]. Internet Computing, IEEE, 2010, 14(1): 44-51.

[10] Weber R H. Internet of Things–New security and privacy challenges[J]. Computer Law & Security Review, 2010, 26(1): 23-30.

[11] Christian Nagel. Introduction to c # classic (fifth edition)[M]. Qi-Libo et al. Beijing: QingHua university press 2009.