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Dynamic Construction on the Examination and Approval Flow of the Rural Land Circulation

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Abstract: Considering complexity of rural land circulation business and non-uniformity of approving flow standard, a dynamic data management method is proposed based on Object Exchange Model, to achieve individual customization for approving flow data structures dynamically. The deal system for land approving in Village-town is developed after mapping the OEM representation of approving flow data to XML description, which can implement digital treatment and auxiliary decision-making analysis of planning program in the process of land approving.

Key words: Rural land circulation, semi-structured data, data model, examination and approval flow

INTRODUCTION

With the rapid development of the rural areas in China, the land use violation cases, such as report after use, approval after build have often occurred. These violation cases reduced the efficiency of the rural land use and resulted into the disordered village appearance. Thus, how to perfect the restraint means of rural land approval stage is one of the major tasks to promote the new village construction. The perfect restraint means can provide a way to achieve the intensive utilization of the rural land and improve rural environment.

Currently, many research institutions at home and abroad have developed a lot of city and rural land examination and approval management system. Because the different land examination and approval business between city and village, it is difficult to directly apply the city land examination and approval management system to rural areas. Existing rural land examination and approval management systems always are suitable to some villages. These systems have no reusability. For example, the process flow for the rural land examination and approval is various. In some villages, the flow may include three business nodes, i.e. peasant application, village committee examination and township government approval. But in some other villages, the business node "Investigation of audit" should be included. Most current systems lack personalized dynamical customization function. These systems are always suitable to some specific villages and are difficult to deal with complex and changeable situations in the land development approval process.

With the above instance of the rural land approval, we can confirm that the same kind of business has various process flows in different areas. So the data structures for these process flows are in varied forms. The data about the rural land approval has the characteristics of the semi-structure (Liu, 2013; Nie and Zhong, 2013). How to organize and manage these semi-structured data validly is the core of the rural land examination and approval management system. The semi-structured data is a kind of irregular data. But it has a certain structure. These data can't be organized with relational or oriented-object model. Object Exchange Model (OEM) is the most representative model for describing the semi-structured data. It has advantages in dealing with the semi-structured data (Stefanakis, 2003; Zhu, 2006; Li and Zhao, 2013). In order to satisfy above requirement, a dynamic data management method based on OEM theory is proposed. The new method can manage the data with dynamic structure generated from the rural land examination and approval. Based on the method, a rural land examination and approval management system was developed.

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DYNAMIC CONSTRUCTION MODEL ON RURAL LAND EXAMINATION AND APPROVAL BUSINESS

In this section, we firstly proposed a describing method for data about rural land examination and approval business. The method can describe the semi-structured data with the OEM objects. Secondly, a parse method OEM frame is given to transform the OEM objects to XML elements. Thus, the semi-structured data can be disposed with the XML documents, i.e. storage, query and update (Li *et al*., 2012; Algergawy *et al*., 2011).

Describing method for rural land examination and approval business data based on OEM: OEM is a simple, self-describing model (i.e. data description is incorporated into the data itself). And it is a common semi-structured data model. All entities in OEM model are described as objects and every object has unique identifier OID, a label, a type and a value (Pan *et al*., 2012; Li and Zhang, 2007; Asai *et al*., 2004). The identifier uniquely identifies the object among all objects in the domain of interest. The label is a string (the tag) presumably denoting the 'meaning' of the object. The type refers to the data type of object value. The data is represented by a collection of objects. The objects are distinguished as atomic object and complex object. The value of an atomic object is of some base type (e.g. integer, string, etc). The value of a complex object is a set of sub-objects. In order to clearly represent the data with OEM, the data can be represented as a directed graph. The node in the graph is OEM object. The leaf node is atomic OEM object and has a value with some base type. The non-leaf node is complex object. It points to the sub-objects. In the graph, the edge is the relationship between objects and the whole graph has a unique root.

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Fig. 1 shows a data sample described with OEM graph. The data is about the contract of a land parcel. Land parcel: {No.:'K01', Area:{Size:125.2, Unit:'ha'}, Type: 'Farmland', Contract: {Contract No. '2013034', Period:' 15 years', Contractor: 'Lihua Zhang'}}.

Following, the data about rural land examination and approval business is used as instance to describe the

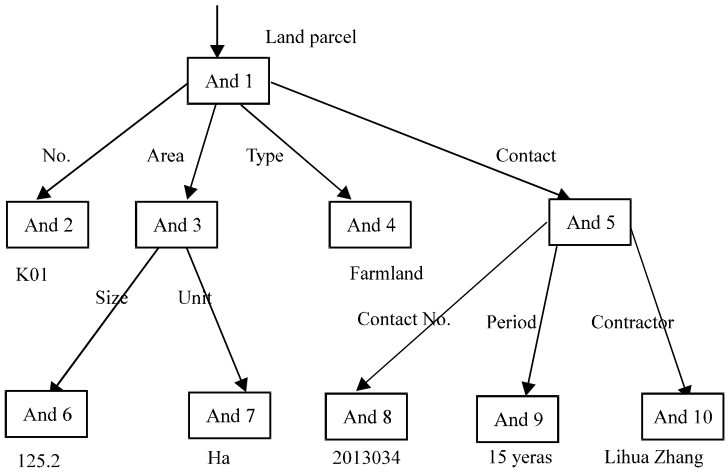

Fig. 1: Data example with OEM graph

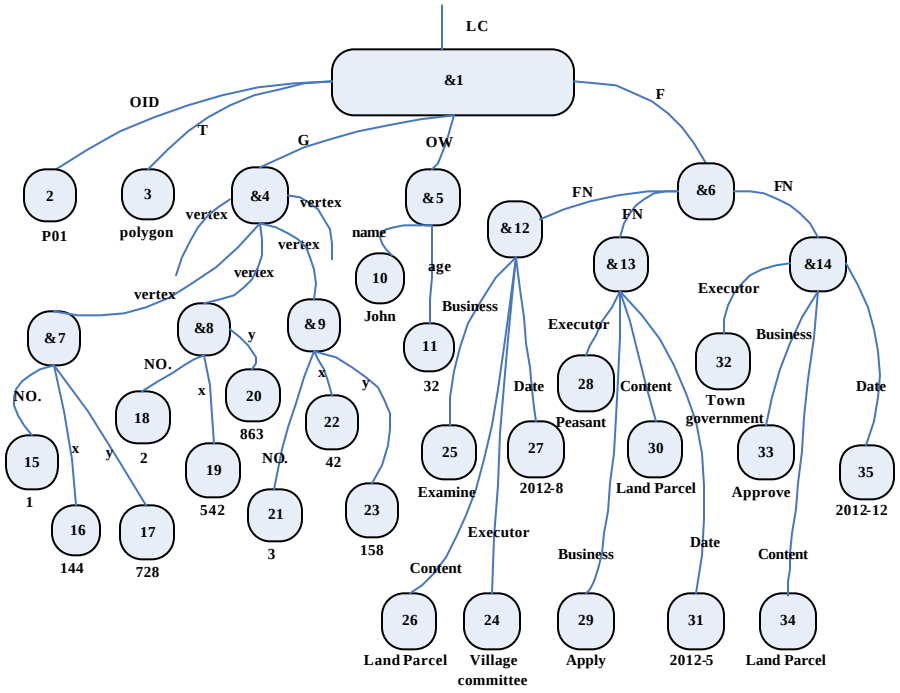

Fig. 2: OEM graph example of rural land examination and approval business

OEM modeling process. The process can detailedly explain the steps and frame of OEM model. The OEM model can realize the data management of the data with uncertain structure. Thus, the model can be suitable for proposing the complex and uncertain rural land examination and approval business in various villages. The land parcel is a kind of spatial object which has identifier, special attribute and space attribute. A spatial object can be defined as a complex OEM object which includes three sub-objects, i.e. figure, theme attribute set and identifier. Their labels are respectively 'S', 'A' and 'OID'. The land parcel is the same as common spatial object.

In the premise of not affecting the accurate description of land parcels, the three sub-objects are simplified. The figure of the land parcel is expressed with geometrical type and geometrical geometry. The theme attribute set is expressed with the owner and the land transfer process. So, the land parcel is described with identifier, geometrical type, geometrical geometry, owner and the land transfer process in this work. The labels of the above components of the land parcel are, OID, type, Geometry, Owner and Flow.

According to the above introduction, a land parcel is defined as an OEM complex object which has label 'LC' and points to five sub-objects. The sub-objects are OID, T, G, OW and F. They respectively express identifier, geometry type, geometry, owner and the flow of the rural land examination and approval business. The geometry type of is common polygon which is expressed with many vertexes. So the geometry is an OEM complex object which points to many vertex objects. The Owner and the flow of the rural land examination and approval business are all defined as OEM complex objects. In this work, the Owner points to two OEM atomic objects. Their labels are respectively 'name' and 'age'. The data types are respectively 'string' and 'integer'. The flow of the rural land examination and approval business is composed of many business nodes. The label of the business node is expressed with "FN". Identifier and geometry type are defined as the OEM atomic object. So, an instance of the flow of the rural land examination and approval business can be described as following, LC:{OID:'P01', T:'polygon', G:{vertex:{NO.:1, x:144, y:728}, vertex:{ NO.:2, x:542, y:863}, vertex:{ NO.:3, x:42, y:158}}, OW:{name:'John', age:32}, F:{FN:{Executor :'Peasant', Business:'Apply', Content:'Land parcel', Date:'2012-5'}, FN:{Executor:'Village committee', Business:'Examine', Content:' Land parcel', Date:'2012-8'}, FN:{Executor:'Town government', Business:'Approve', Content:' Land parcel', Date:'2012-12'}}}.

As showed in Fig. 2, the flow of the rural land examination and approval business includes three business nodes, i.e. peasant apply, village committee examine and town government approve. If the flow of the rural land examination and approval business has new

business node, for example, field investigate, the object 'F' will point another business node object which has label 'FN'. The new object is an OEM complex object. It points four OEM atomic objects, i.e., Executor, Business, Content and Date. The old data structure has no need to change. The OEM description of the new object is as following, FN:{ Executor: 'Town government', Business: 'Field investigate', Content: 'Land parcel', Date:'2012-10'}. Thus, based on the above data model, the rural land examination and approval management system can dynamically define the various flow of the business in order to be suitable for different requirements.

Representing the OEM model with XML: With the OEM frame, the irregular data can be flexibly described. In this section, the storage and disposal method of the irregular data is discussed. XML is a kind of markup language defined by World Wide Web consortium and is suitable for representing the semi-structured data. The data model defined as above can be converted into XML language description. In an XML document, there is a single root element. The present XML document parser (XML Parser) has two kinds of standard [9], i.e. SAX and DOM. SAM adopts time-driven mode and processes it as XML data flow in turn. DOM adopts document driven mode. XML data is organized into tree-like structure in the memory according to the logistic structure at first during processing, and then operate the node tree of the memory. In this work, the DOM is adopted as the parser. The OEM complex object can be mapped as an element in the XML document and the OEM atomic object can be mapped as an element with values. The part XML document mapped from Fig. 2 is showed as following:

```
<LC>
 <OID>P01</OID>
 <T>polygon</T>
 <G>
 <vertex>
 <NO.>1</NO.>
 <x>144</x>
 <y>728</y>
 </vertex>
 </G>
 <OW>
 <name>John</name>
 <age>32</age>
 </OW>
 <FN>
 <Executor>Peasant</Executor>
 <Business>Apply</Business>
 <Content>Land parcel</Content>
 <Date>2012-5</Date>
 </FN>
</LC>
```

IMPLEMENT OF THE SOFTWARE

A rural land examination and approval management system is developed based on the above method. The system includes UI control model, basic data proposal model, examination and approval flow custom made model, examination and approval disposal model, mapping model. The examination and approval flow custom made model, examination and approval disposal model are two core models. The system can realize various rural land examination and approval business. In the same time, the system provides many assistant functions, such as add data layer, remove data layer, data input and output, mapping, query data and so on. The important characteristic of the system is to deal with all kinds of rural land examination and approval business without regard for the different flow in different villages. The structure of the system is showed in Fig. 3.

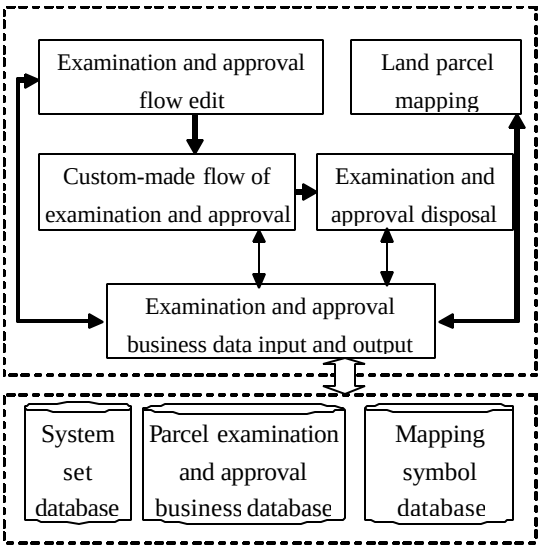

Fig. 3: Structure of the system

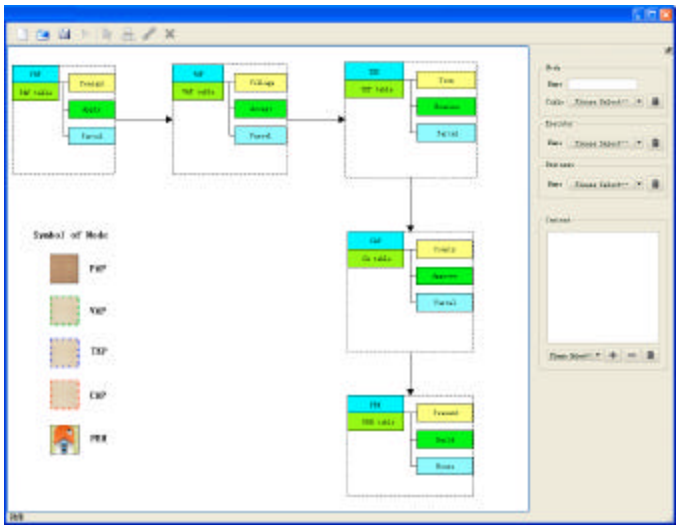

Fig. 4: Custom-made flow in the system

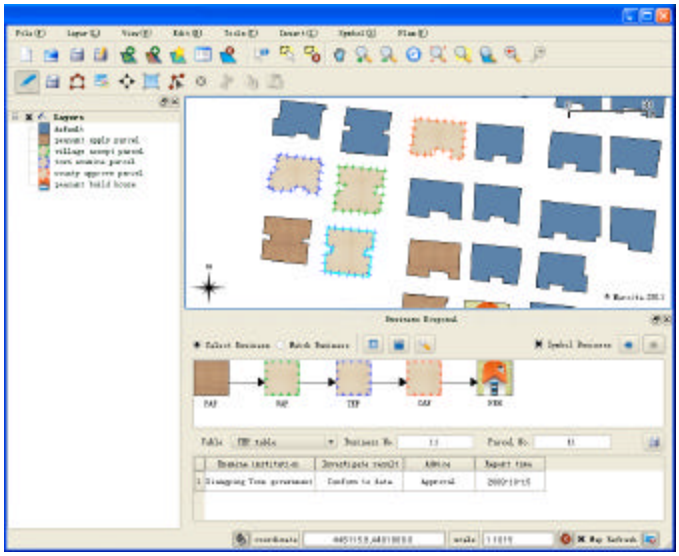

Fig. 5: Disposal process of the land examination and approval management in a map face

As show in Fig. 4, the flow of the rural land examination and approval management in a county includes five business nodes, i.e. Peasant Apply Parcel (PAP) node, Village Accept Parcel (VAP) node, Town Exanimate Parcel (TEP) node, County Approve Parcel (CAP) node and Peasant Build House (PBH) node. These nodes can be dynamically custom made in the system with a friendly interface. And Fig. 5 shows the disposal process of the land examination and approval management in a map face. With the system, the users can dispose almost all of the land parcel business. And the business disposal can be integrated with map data.

CONCLUSIONS

In the practical rural land examination and approval business, there are many complex instances. The system based on the new method proposed in this work can flexibly dispose these cases. And the system has been applied in many villages. With the system, the rural users with low computer level can deal with the complex rural land examination and approval business. According to statistics, comparing with the professional institutions and systems, the cost with the system is saved 80-90%.

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