THE COMPONENT-BASED DESIGN AND DEVELOPMENT OF REMOTE SENSING SYSTEM FOR DROUGHT MONITORING*

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ABSTRACT

In field of drought monitoring, remote sensing technique has attracted more and more attention during recent decades, and many effective methods and models have been proposed. For instance, the thermal inertia model and active microwave remote sensing methods (Moran et al., 2000) have achieved better application on the drought monitoring over bare soils. For vegetated surfaces, Perpendicular Drought index (PDI, Ghulam et al., 2007a), Vegetation Condition Albedo Drought Index (VCADI, Ghulam et al., 2007b), Shortwave Infrared Perpendicular Water Stress Index (SPSI, Ghualam et al., 2007c), Crop Water Stress Index (CWSI, Jackson et al., 1981), and Temperature Vegetation Dryness Index (TVDI, Sandholt et al, 2002) and so on, have also been widely used to reflect the drought status with different vegetation coverage fraction.

However, despite the advance of drought monitoring technology has come a long way, remote sensing software and platform has been lagging behind the applications. In the existing software of general-purpose remote-sensing image processing, there is no special drought monitoring module, which makes a variety of complex and diverse models can not be directly applied. Furthermore, the architecture of most existing software is not flexible and can not be operationally extended on new models and methods, especially for the higher requirement of the implementation of models based on the N-dimensional feature space. All of these limits have affected the application of remote sensing in drought monitoring, it is therefore necessary for us to develop professional remote-sensing software of drought monitoring with strong flexibility. For this purpose, our team carried out extensive exploration in the past few years (Wang et al., 2004; Li et al. 2006; Jin et al.,

* Thanks to the R&D Special Fund for Public Welfare Industry of China (Meteorology): (GYHY200806022), the National Natural Science Foundation of China (40771148), and the High-Tech Research and Development Program of China (2009AA12Z128 and 2008AA121806-04) for funding.

2007), including the implementation of PDI module in remote sensing support system (Qin et al., 2006), and noted that the component technique can well meet the development requirements. Now, we have adopted a component-based approach to design and develop the Remote Sensing Drought Monitoring System (RSDMS), and this work introduces the system design and key techniques of development in detail.

According to the Component Object Model (COM) theory, in combination with requirement analysis, we design the architecture of RSDMS, shown in Figure 1. RSDMS is divided into three main parts as follow:

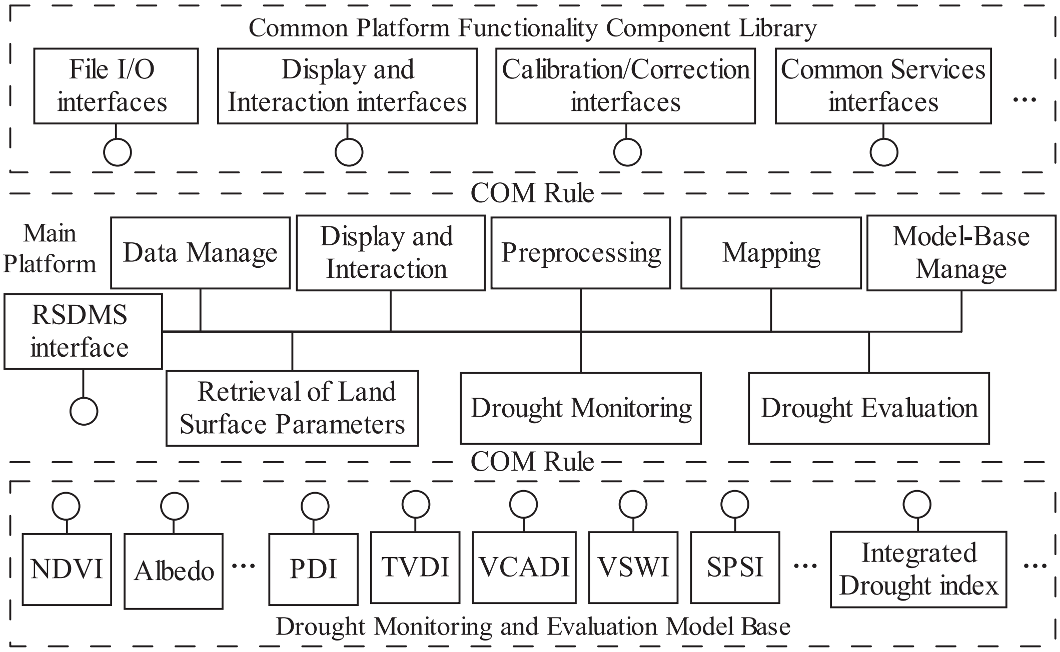

Figure 1. The Structure of RSDMS

(1) Main platform of RSDMS

Following the design concept of COM, RSDMS is designed to be having excellent reusability and scalability. The main platform performs as a container of function modules, whose main functions are carried out by calling a series of components. Besides, some common functions are encapsulated and provided externally in the form of standard interface, namely RSDMS interface in Figure1, which enables customers to extend their own functional blocks, including new data format input/output (I/O) drivers and model components. What is more, the manage block of model-base also allows users to operate the internal and external models of the system.

(2) Common Platform Functionality Component Library

This component library is constituted of component-based general-purpose functional modules of remote-sensing image processing and common services components. General-purpose functions of RSDMS include File I/O, data preprocessing (radiometric calibration, atmospheric correction, geometric correction, etc), display and user interaction, etc. Common services components in the system, for example the progress reporting component, provide services for other modules.

(3) Drought Remote Sensing Monitoring and Evaluation Model Base

This model base is the core composition of RSDMS, in which models can be grouped into three categories from a functional point of view: the retrieval of land surface parameters, such as Normalized Difference Vegetation Index (NDVI), Albedo, etc; drought monitoring model, such as PDI, TVDI, etc; drought evaluation model, such as Integrated Drought Index, etc.

Then, we design data structure, data flow and interface specification for RSDMS, and set up the main platform with MFC6.0 in WinXP environment. ActiveX Template Library (ATL) and ActiveX control technique in VC++6.0 are used to help programming the component library and model base, which achieves general-purpose image processing function and also integrates a variety of widely-used monitoring and evaluation models. At present, our system has been developed and tested well, and the preliminary application has been implemented for drought monitoring and assessment in Ningxia region of northwestern China.

Keywords: Component-oriented; Remote Sensing; Drought Monitoring; System Design and Development

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