MathML Based Browser for the Web Application

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Abstract—Recently, many kinds of XML based application services are widely used in internet. And the markets for mathml editor are needed for the technology combined with other text editor. We are developing a system for MathML based browser and editor for the service of internet application. MathML based browser is applicable for e-book service and many kinds of document system. This system is composed of document editing module and displaying processing module. This system is useful for the processing of MathML tag by unexperienced users with MathML syntax. Users can edit the math tag's document with ease and efficiently. Based on XML, many parser functions are optimized for the speed of document processing. This system can afford to the development of internet world.

Index Terms— e-book service, MathML document editor, XML

I. INTRODUCTION

MathML is a standard markup language by W3C, which is aimed for description of mathematic equations. It defines the definitions of syntax structure for mathematic processing and contains the mathematical content information. It is based on XML technology. In near future, the MathML based web service will also become a mobile killer application.

Generally, description for mathematic equations on the web is conventionally represented by text and image format. This makes it difficult to read and represent the mathematic equations. One of the constraints is the big file size by image format representation, which makes a burden of processing and exchanging between documents. And reusability of equation's templates is harder when users want to reuse the equations into another mathematics documents, to index and to retrieval. MathML specification is proposed for solving these kinds of problems and has progressed with other kinds of markup based languages standardization. It seems to be efficient for the mathematic representations on the web and mobile platforms. To use MathML, it demands the editing of math documentation and the knowledge of complex MathML document structure information like MathML DTD(Document type Definition) syntax[1][2].

We have developed a user oriented MathML editor system that composed of basic editing functions and WYSIYG interface. It is possible to edit and verify the browsing results simultaneous during the modification of document. Because it provides the browsing function for the edited MathML tag, it is easy to confirm the document correctness directly. We focused on the user interface and speed optimization for document processing to run on various thin client mobile devices. The parsing dependent modules are especially minimized for the consideration of the portability into other devices.

A research directions on MathML can be categorized into two kinds of areas, one is for presentation markup based research and the other for content markup based one. The classifications are distinguishable by functions, such as token elements, general layout schemata, scrip and table. In this paper, we focus on the system development targeting for the presentation of mathematic equations.

II. SYSTEM DESIGN

Fig. 1 illustrates the function's modules of current MathML editor system. The input MathML document are passed into XML parser of document processing unit and parsed. The results are MathML node structures similar to DOM(Document Object Model) and managed by structure manager module. MathML node objects are transmitted the information into the displaying processing unit through structure manager module and also views in the area of view window. User can modify the MathML document with the editor interfaces providing by document editing unit[3].

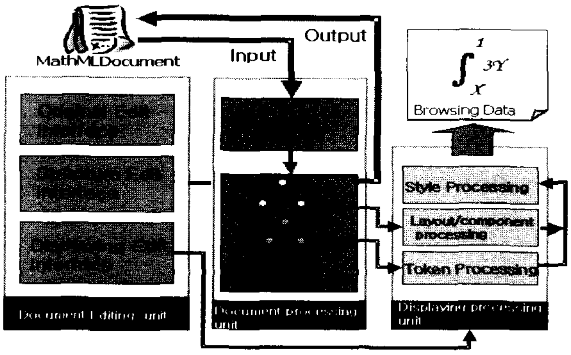


Fig. 1 Block diagram of the MathML editor system

A. Document Processing Unit

The document processing unit plays a role in input and output of MathML document and reconstruction into MathML node structures which defined in document editing unit. And then the node structure information are reflect on displaying processing unit. The document processing unit is composed of tag recognizer module, event processing module and MathML node structure manager module.

The tag recognizer is searching the tags from documents in sequence and recognizing into start tag, end tag and empty tag. It transmit element name, attribute name, node information into the event processing module. The event processing module performs the parsing like event-driven SAX(Simple API for XML) parser. During this process, tree-like MathML node structure are generated with processing instruction node, element node and text node. And then the node structure manager module manages the MathML node structure. The node structure manager module continues recursive action on MathML document saving, mathematic equation browsing from document editing unit and another kinds of editing interfaces. The result node information are applied into the displaying processing unit and the MathML document.

B. Document Editing Unit

The document editing unit is the combination of origin document edit interface, structure edit interface and displaying edit interface. The origin document edit interface provides a editing function of basic original document text. The structure edit interface supports the structure representation for logical hierarchy and document editing. The displaying edit interface controls modifying and editing for the mathematical equations directly. The three interfaces are related with MathML node structure manager module and synchronize data among three interfaces.

C. Displaying Processing Unit

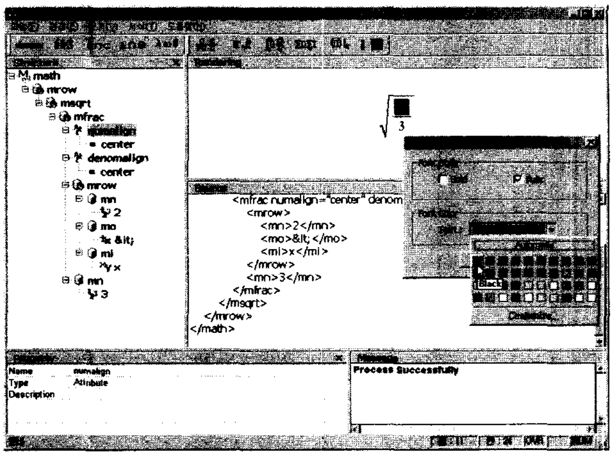
The displaying processing unit performs browsing the mathematic equations in the viewer window. This unit segregate the recursion node information into single node module or group node module. The single node module is the form of token format and the other group nodes are like the root equation. To display mathematic equation objects, basic object can include low level objects. The low level objects are defined with CMathObject class, which has the member function for global area information, current node information and MathML node basic information.

III. IMPLEMENTATION

The mathematic equation editor are composed of displaying window for browsing mathematic equation and editing, document structure window for transformation MathML document into tree structure, origin document editing window, property window for displaying the node's detail information and error message window for abnormal processing or processing status[4][5].

A. Displaying Edit Interface Module

Figure 2 illustrates a example of editing operation for MathML document. The browsed mathematic equation can view the specific characters in color and allows to modify the font information with style attribute editor. User can modify the mathematic equations directly in displaying window with keyboard, tools bars are applied for special characters and component tools to get over the difficulties with keyboard method. The rendered information are applicable into origin document that it allows for users to use MathML editor without knowledge of MathML.



```
<mfrac numalign="center" denom
  <mrow>
    <mn>2</mn>
    <mo>&lt;</mo>
    <mi>x</mi>
  </mrow>
  <mn>3</mn>
 </mfrac>
 </msqrt>
 </mrow>
</math>
```

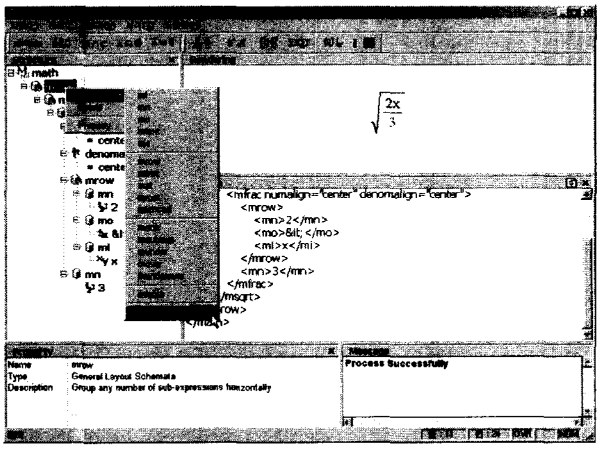
Name numalign
Type Attribute
Description

Process Successfully

Fig. 2 Snapshot of editing for MathML tag

B. Structure Edit Interface Module

The structure edit interface module provides editing functions for mouse click event operations in structure window and support pop menus. If you choose the node, the node property information are described in bottom window. To add new element or attribute in destination node, it provides some information for destination node. And to insert low level node, it references the MathML DTD and decide the candidate element nodes or attribute lists from pop menus that it is beneficial to write valid document without referencing DTD.



```
<mfrac numalign="center" denomalign="center">
  <mrow>
    <mn>2</mn>
    <mo>&lt;</mo>
    <mi>x</mi>
  </mrow>
  <mn>3</mn>
</mfrac>
/msqrt>
row>
</m
```

Name mrow
Type General Layout Schemata
Description Group any number of sub-expressions horizontally

Process Successfully

Fig. 3 Snapshot of editing for document structure window

IV. CONCLUSIONS

This paper is described for the MathML based editor. Using this system, user can write the MathML equations easily and adapt this equations into other word processor. Currently, this system is operating on the window based PC. But it is not difficult for S/W routines to port into mobile device. We are planning to extend further user interface functionality such as pen based input method.

REFERENCES

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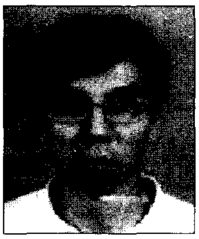
[4] http://www4.ibm.com/software/network/techexplorer/
[5] http://www.w3c.org/Amaya/



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Dr. Kim was born in Seoul, 1965. And he graduated at computer engineering department of Kwangwoon university from 1985 to 1991. After school, he joined ETRI. His experience in ETRI was development related with audio processing technology, like HDTV project and MPEG-2 AAC audio codec. Now, he is interesting at metadata processing and standardization of Mobile application service.

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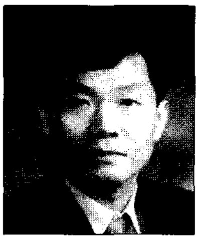

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