二/m 班/q, Class 2, Grade 1, Xinhua primary school), sequence words (such as: the first, second), pronouns (such as: this, one, that.). In addition, it also includes the combination of several categories, such as: '二/m 年级/n 三/m 班/q 教室/n 里/f, in the classroom of Class 3, Grade 2'. These contents are built into a common knowledge base to match the first cell and judge whether it is 'owner'. On the other hand, according to the value of 'owner' and 'object' slot of the sentences before or after this You-sentence, if the content is the 'owner' or 'object' in the previous or the next sentences, it is also 'owner' or 'object' in this sentence. Thus the above two laws can confirm the cells' content are 'owner' or 'object'.

If You-sentences included complicated key words, the processing will be different based on different key words. Variables are determined by these key words, but the Most of the variable slots in You-sentences are null and they are processed when solving problem.

4. The word problem auto-solving system and examples of auto-solving method

The word problem auto-solving system is composed of seven modules: user interface module, preprocessing module, semantic understanding module, auto-solving module, problem answer presenting module, common knowledge base and mathematical formula base. The overall system structure is shown in Fig. 3.

From the user interface module users input the word problem in Chinese, then the Chinese word segmentation and Part-Of-Speech Tagging is accomplished and the stop-words are removed in the preprocessing module. These stop-words include: '问/v', '问/v ：/w', '可/v 是/v', '已/d 知/v', '那么/d', '则/d', '若/c', '如果/c', '知道/v' ('inquire/v', 'inquire/v ：/w', 'but/v', 'known/v', 'then/', 'so/d', 'for/c', 'if/c', 'know/v')and so on. In the semantic understanding module, the word problem is split into several sentences by punctuation. The sentences components are filled into framework slots by different processing algorithm based on different sentence patterns. In auto-solving module, first, the variables in corresponding formula are determined by complicated key words. If there are no complicated key words related to all variables, it will infer the variable relevant to the sentence from the summarized rules. Then the formula for solving the problem is determined by one or two variables, the variables are replaced by quantities and the answer is deduced. If the calculation goes wrong, this type of error usually arises from the inconsistent 'owners' or the inconsistent 'objects' between two sentences. At this point, the system will call on a common knowledge base and continue to reason by the required common knowledge. The problem answer presenting module feeds the problem-solving steps and the final answer back to the users at last.

The system could automatically work out all word problems composed of You-sentences. The examples of word problem auto-solving are shown in Fig. 4. The figures present how to fill You-sentence in the framework, namely, the understanding results of You-sentence.

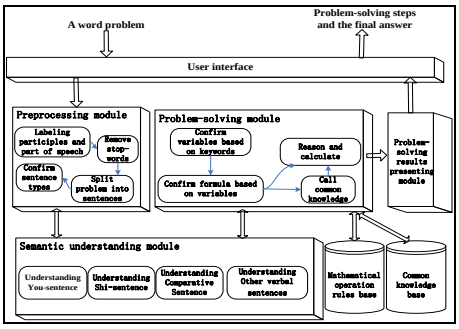

Fig. 3: The Architecture of Word Problem Auto-solving System