



International Congress of Information and Communication Technology (ICICT 2017)

A Scenario Representation Model for Emergency Decision Support

Liu Cheng, Yu Shuiping, Qian Jing, Yuan Shengcheng, Ma Xun, Liu Yi *

Inst. of Public Safety Research, Dept. Eng. Phys. Tsinghua University, Beijing 100084, CHINA

** Corresponding author: liuyi@tsinghua.edu.cn Tel.: +86-10-62792860*

Abstract

In this paper, a scenario representation model for emergency decision-making support is developed. It consists two components which are formal description of object and formal description of emergency status related to the object. Conceptual architecture of the model is also discussed. Advantages of this scenario representation model lies in four aspects: flexibility in describing dynamic evolution of emergencies; helping in define certain scenario and clarify its boundary; universal representation which contributes to similarity assessment. Moreover, the scenario representation model developed in this paper helps in evaluating emergency severity and effectiveness of decisions.

Keywords: scenario representation model, scenario-based reasoning, emergency decision support system

1. Introduction

Case-based reasoning is widely accepted in decision making support¹⁻³. In recent years, the idea of scenario-based reasoning has been a new research focus especially in the area of emergency response and management^{4, 5}. Due to the large temporal and spatial scale of emergencies, decision-making process is dynamic and decision objects are not fixed. One emergency case may contain several scenarios that differs quite a lot as well as the decision objects. It is often the case that emergencies are studied and analyzed by scenarios instead of by cases. Scenario representation model is one of the basic issues for scenario-based reasoning and has got more research attention recently.

Renate L et al. used scenario-based reasoning in emergency healthcare and represented a scenario as a use-case by extended UML 2.0 sequence diagrams⁶. Junhu R et al. described how to represent the transportation emergency scenario when using scenario-based reasoning in emergency path selection⁷. Chongguang Wu developed a Scenario Object Model for HAZOP-related information in chemicals emergency response⁸. Yu Feng et al. discussed the scenario representation of power line trip instance with ontology and semantic network⁹. Moehrle, S and Raskob, W analysed major features of scenarios of nuclear events in the early and later phases when integrated case-based

reasoning with scenario-based reasoning in nuclear emergency response¹⁰. Research interests in scenario study grow rapidly in recent years and general scenario representation model is still under developed.

In this paper, the formal scenario representation model for emergencies is developed. Formal definitions are introduced and conceptual architecture are discussed in detail. The content of this paper is as follows: in section 2, formal definitions of the scenario representation model are introduced. Conceptual architecture of the scenario representation model is described in detail in section 3. In section 4, conclusions are provided and ideas of possible future works is discussed.

2. Scenario Representation Model

In this paper, a ‘scenario’ refers to a ‘picture’ of very small section of the emergencies which include mainly one object. ‘Scenario’ describes features of the object and how it suffers from the emergency. With such idea of ‘scenario’, the formal description of scenario representation model developed in this paper consists two components: formal description of object and formal description of disaster status related to the object.

2.1. Formal description of the scenario representation model

Object is any entity that exists in emergency influenced area and may be damaged or destroyed by the emergency. Formal description of object is as follows:

Definition 1: *Object*

‘Object’ refers to entities that may be damaged or destroyed by emergencies, and is denoted by e .

Definition 2: *Attribute of object*

Attributes of object are denoted by A , which is pair with formation of $A = (A_{name}, dom(A))$, where A_{name} is words set that refers to names of attributes and $dom(A)$ is the value domain. $A(e_i)$ denotes attributes of certain object e_i , and $A(e_i) = (A_1, A_2, \dots, A_m)$ where $A_m \in A$.

Definition 3: *Object category*

Object category is an object set and denoted by E_j , where j represents certain category.

Definition 4: *Formal representation model of object*

If $\forall e_i \in E_j$, statement ‘ $A(e_i) = (A_1, A_2, \dots, A_m)$ represents attributes of object e_i ’ is true, set $A(e_i)$ is defined as the formal representation model of object.

Fig. 1 shows an example of formal representation of a certain object. “Tank” is an object category containing several objects which has the common attributes: volume, storage, storage product, material of tank, and tank structure. No.103 oil tank and No.5 hydro-wax tank are two different objects in the object category “Tank” which has different attributes values.

2.2. Formal representation model of emergency status related to object

Emergency status related to object is presented with several dimensions each of which refers to a certain damage type. The formal representation model of emergency status related to object is as follows:

Definition 5: *Emergency status related to object*

Denote ‘emergency status related to object’ as d .

Definition 6: *Element of d*

Element is defined as certain damage type. Elements of d are denoted by \bar{A} , where \bar{A} is pair with formation of $\bar{A} = (\bar{A}_{name}, dom(\bar{A}))$, where \bar{A}_{name} is words set that refers to names of elements and $dom(\bar{A})$ is element value domain.

Download English Version:

<https://daneshyari.com/en/article/4961081>

Download Persian Version:

<https://daneshyari.com/article/4961081>

[Daneshyari.com](https://daneshyari.com)