The Research of Community Risk Monitoring System Based On Multi-Agent and Data Mining

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Abstract. According to the data from the Ministry of Health, about 2 million persons suffer injuries every year in china. Among them, 700 000 to 750 000 died due to injury. At present, most communities in China are lack of Injury Monitoring System, although some communities perform the injury monitoring, they just collect the data simply. Injury monitoring data contributes to reducing the threat to life and property. Agent's autonomy, initiative, social greatly contribute to solving a distributed, structured and semi-structured injury information. Using Multi-Agent and data mining techniques to construct community monitoring injury system can largely reduce the injury to the residents.

Keywords: Multi-Agent; safe community; injury; Distributed

1. Introduction

As the acceleration of building safe community, there are more and more problems to be solved, such as infrastructure and planting, the introduction of community management personnel and so on. The most important thing is to prevent and reduce the incidence of various injuries. Protect life and property of community residents.

The birth and development of Intelligent Agent technology is the inevitable result of the development of distributed artificial intelligence technology and network technology. The research of Agent and Multi- Agent has become a hot area in recent years. Multi-Agent Systems (MAS) is to accomplish a task through coordination and services together. Activities between members of the Agent is an independent self-government, their own goals and behaviors unrestricted from other Agent, which means through competition and negotiation to resolve contradictions and conflicts between each other. The main purpose of MAS is composed of multiple Agent interactive groups to solve large-scale problems beyond the capacity of individual Agent. Community Injury Monitoring System Based on Multi- Agent and Data Mining aimed at resolving the problems of reducing the incidence of injury and accelerating the pace of building a safe community.

2. Injury Monitoring System Structure

2.1. Current situation of injury monitoring

Community agencies to conduct injury monitoring mainly contain Primary and secondary schools, the neighborhood committee, Community Health Center, Hospital and Centre for Disease Control and Prevention. Currently, these agencies are monitoring injury separately. Data is not shared, which make against the overall understanding of injury data and drafting disease prevention and control strategies. Some agency's injury monitoring is performed manual survey, which can not form the knowledge library and lack of timeliness.

2.2. The introduction of Agent

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The concept of Agent is different with the research and concerns vary. Generalized Agent includes human, physical world of robots and information in the world of software robots. Narrow Agent just refers to the information in the world of software robots or software. The Agent is the software Agent. Agent has four basic characteristics [1]:

- autonomy, Agent can run regularly without the person or other Agents and have some abilities to control their actions and internal status;
- social ability, Agent can communicate with some language;
- reactivity, Agent can perceive the surrounding environment and respond to it;
- pre-activeness, Agent can not only make some simple reactions to the surrounding environment, but also start by receiving some simple information, further show the targeted behavior.

These features show that the Agent does not only emphasize that the individual self-control ability, but also emphasize the coordination of teams. Therefore, use of Multi-Agent in the multi-agency environment has great flexibility and adaptability.

2.3. The basic process of injury monitoring

In the starting period of developing the safe community, hidden danger and injury information should be collected as the basic data. In the construction period of safe community, Agent analyzes the basic information, proposes the existing main problem in the community predicts some injuries and make intervention measurements. Finally, Agent assesses the intervention process, intervention effectiveness, intervention benefit and intervention utility.

2.4. Injury monitoring system structure

As the entire process of injury monitoring, this paper put forward the structure of the injury monitoring which based on Multi-Agent and Data Mining. The structure is showed as Fig 1. System works together through the following Agents to complete the task of injury monitoring [2] [3]:

- Information collection agent

Community agencies add injury data to the appropriate database through the human-computer interaction. Agent can examine automatically whether the injury data already exists in the databases, for fear of the redundant data, and ensure the validation of the input fields. System provides two ways for data collection: the one is through the form submission to complete, the other is through the existing file import them into the database. In addition, the schemes of database table should be consistent.
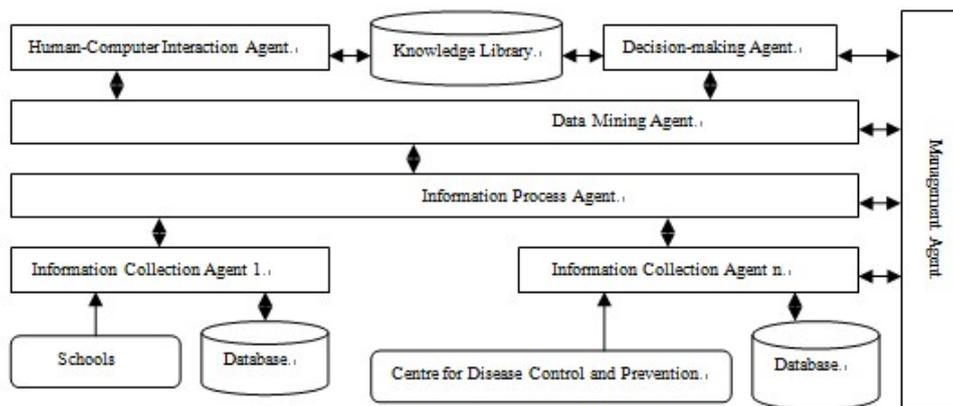

Fig.1. the structure of injury monitoring

- Information processing agent

Using the distributed database technology, the databases are dispersed from physical, but they are the whole from the logic. Information Processing Agent carries out the statistical analysis of single field, multi-field cross-analysis and the trend of some fields in different year. These results can be used by Decision-maker and Decision-Agent. JFreeChart technology is adopted to achieve these results. The whole process of analysis runs automatically without human involvement. The analysis result of cross-field is showed as Fig 2.
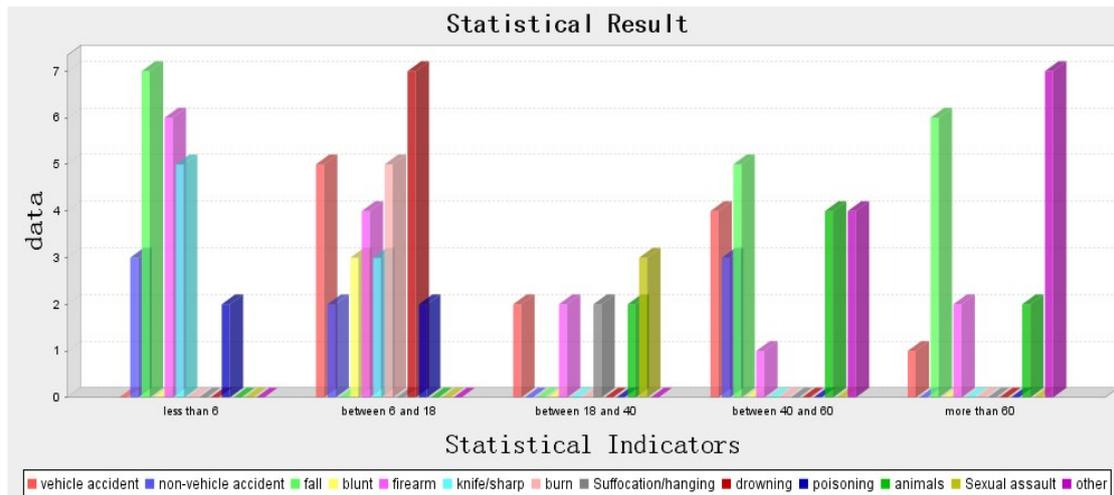
Fig.2. the structure of injury monitoring

- Data mining agent

In this system, we use association rules data mining algorithm. Association rules reflect the mutual interdependency and relevance between one thing and other things. If there is relevance between two things or among several things, therefore, one thing among them will be forecasted through another thing. R. Agrawal from IBM Almaden Research Center proposed the model of association rules firstly and gave the Algorithm AIS. Then SETM and Apriori Algorithm were appeared. Apriori is a classic algorithm for learning association rules. Association rule mining is to find out association rules that satisfy the predefined minimum support and confidence from a given database. The problem is usually decomposed into two sub problems: one is finding those item sets whose occurrences exceed a predefined threshold in the database; those item sets are called frequent or large item sets, the other is generating association rules from those large item sets with the constraints of minimal confidence.

The second problem is simple, current researches are focus on the first problem that is how to efficiently find the large items. Here is a general method of finding large items [4]:

Step1: First find the the large items which length is 1.Marked them with $L[1]$.

Step2: Based on the $L[k]$, generating candidate set $C[k+1]$, which must be guaranteed that including all $L[K]$.

Step3: Testing support of all $C[k+1]$ using the transaction database's transaction to find the large items $L[K+1]$ that length is k+1.Compute the support of each candidate sets, if support than minisup, then join it into $L[K+1]$

Step4: If $L[K+1]$ is empty then end. $L[1] \cup L[2] \cup ...$ is the result; Otherwise go to (2), and continue.

We store the association rules that we dig out to the knowledge database. These association rules can be used by Decision-maker and Decision-Agent.

- Decision-making agent

Transform the result of information processing Agent and Data Mining Agent, generate the words and images which Decision-maker can understand. Specific process is to decompose decision-making problem into several sub-problems, and these sub-problems then processed by the sub-unit of decision-making. Collection processing results and form the final result of decision-making.

- Management agent

Management Agent manages the all the Agent in the system and responsible for communication among Agent. It mainly includes two parts: Agent Definition Library and Agent Activity Library. Agent Definition Library is used to store handle of each active Agent (such as the service IP, node name, message format etc). Agent Activity Library is used to store the current status of all active Agents (such as the busy sate, processing power, etc). The structure of management agent is showed as Fig 3.
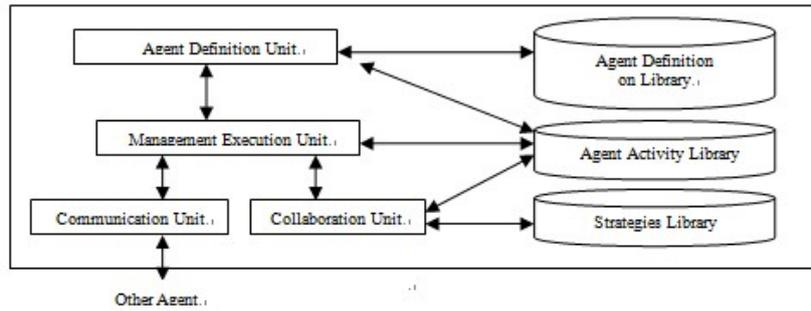
Fig.3. the structure of management agent

The main functions of the management agent as follows: firstly, management function, responsible for creating and destroying active agent in the period of system running according to the request of other's agents and the situation of status library. Secondly, collaboration function, an Agent can send a request to the management Agent when it cannot complete a task. Management Agent searches for a suitable Agent in the Agent Activity Library to coordinate with the Agent which needs the help to fulfill its task, if management agent cannot find a suitable Agent, and then Management Agent creates a new active Agent. Lastly, communication function, Knowledge Query and Manipulation Language (KQML) defines a standard syntax and some expression of expressing behavior. It provides a common framework to Multi-Agent System for communication and collaboration. In particular, it provides a set of identification, link building and information exchange agreements. For example, Agent A sends a behavior expression to Agent B's message as follows:

```
(ask-one
                    : sender A
                    : content "bar(X, Y)"
                    : receiver B
                    : in-reply-to ido
                    : reply-with idl
                    : language Standard_Prolog
                    : ontology foo

     )
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3. Summary

From the perspective of computer science, this paper researches injury monitoring system of community by using Multi-Agent and data mining techniques and make the detailed description of every agent involved in the system. Injury monitoring system plays a very important role In the process of building safe communities. The establishment of a scientific, comprehensive injury monitoring system has significant meaning.

4. Acknowledgements

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