

Research on wisdom urban public security management system integrated into the situation of urban safety

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Abstract

With the expanding of the sizes of the cities, the urban population and property space distribution becomes more concentrated, urban public safety incidents into the increasingly frequent stage. How to intelligent and efficient manage the urban public safety is imminently. On the basis of defining the urban security situation management model systematic, this article will establish the urban safety stratified hierarchical data acquisition of internet of things which is based on urban monomer-group region, study the tracking-summarized-warning-optimization handling mechanism which support the city security complex event, construct the wisdom urban public security management system which is integrated into urban security situation and provide an effective means to realize the wisdom management of the city public security.

Keywords: public security, safety situation, wisdom city, internet of things

1 Introduction

With the acceleration of the process of Chinas urbanization and the expanding of the sizes of the cities the space distribution of urban population and property become more concentrated which bring a few challenges to urban public security management. Statistical material shows that Chinas annual economic losses due to public security issues are about 650 billion Yuan, accounting for 6% of the total GDP. In order to build an efficient urban public security management system, many scholars and enterprises conduct a large number of explorations respectively from theoretical and practical aspects. Study from the theoretical point of view, like Chengyu Zhan set Beijing for example, raised the urban emergency response system which is to prevent and control the uncertainty of public risk [1]. Rongzhi think that to manage urban risk, which is often complex and likely to go out of control, it is highly necessary to establish integrated and highly-effective risk control system and public security management system so that emergency response and post-accident management would give way to the proactive public risk management system [2]. Through comparative study of urban public safety management system between Japan and the United States, Chen Hua put forward the four stages of urban disaster emergency management system which including disaster prevention, disaster early warning before the response, post-disaster recovery and after monitoring assessment [3]. From the practical application perspective, after announce The advice of further carry

out the construction of Ping An by the central politics and law committee, the central social security comprehensive management committee in December 2005, the construction of urban public safety management system has made outstanding progress [4-6]. By layout all kinds of safety monitoring terminal equipment in the major hazards and social public facilities, the government has initially established an internet of things system which can real-time security monitoring and early warning the urban public facilities and source of danger [7]. And on this basis, the government has initially establish the urban public safety management system to different industries, and to a certain extent, realize the tracking, early warning, analysis and rescue to urban public security.

However, the current construction of the urban public security management system still has the following problems: first of all, the existing system is mostly set up by industry, which leads to relative isolate between application system, interactive coordination is not enough, and the source of data between different application systems has a typical distributed heterogeneous data characteristic. The system also faced with some problems, such as scattered, isolated, single and the effective integration of heterogeneous data resources [8].Second, most of the existing system is a kind of extensive static management and affairs management, but as the rapidly application of the internet of things technology, it is possible to realize the real-time tracking and accurate data collection of urban public security object. Third, what the existing system mostly considered is unidirectional management, especially in

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the process of urban public safety emergency rescue, the system generally acquisition the scene of the accident data simply and unidirectional. But with the development of the internet of things, how to feedback all kinds of safety information to the rescue site by the internet of things in the process of emergency according to the requirements and characteristics of the new period of urban public safety management, this paper has put forward the architecture of the wisdom urban public security management system which is integrated into the situation of urban safety, and mainly studies the stratified hierarchical safety data collection network, the urban security situation management model, the urban security incident two-way processing mechanism, the urban safety data exchange framework and some other key technologies [9].

2 System framework

The wisdom urban public security management system framework this paper has put forward is shown in Fig.1. This system includes facilities layer, network layer, data layer, function layer and application layer, its corn is to layout different types of the internet of things facilities near the urban safety management object and bring different kinds of urban safety management object into

the range of the wisdom urban public safety management framework. Moreover, with the support of the urban public safety management system to realize whole journal, dynamic, intelligent and fine management of the urban security management object according to different industry application requirements [10]. Among the layers, the facilities layer refers to different kinds of equipment and facilities, which can conduct real-time tracking and data collection to different sites. The network layer is refers to network technology which support the safety data highly speed acquisition and reliable transmission. The data layer introduced into the safety situation ontology model and then put forward the complex urban security environment-safety management object-safety resources mapping mechanism, established the heterogeneous distribution of urban public safety data integration view, which integrated the urban safety situation, and urban public safety data exchange framework. The function layer includes safety early warning management, event location management, safety plan management, field rescue management, resource scheduling management and statistical analysis management. The application layer combined with application requirements from different industries, relying on all kinds of application systems developed by urban public safety management platform.

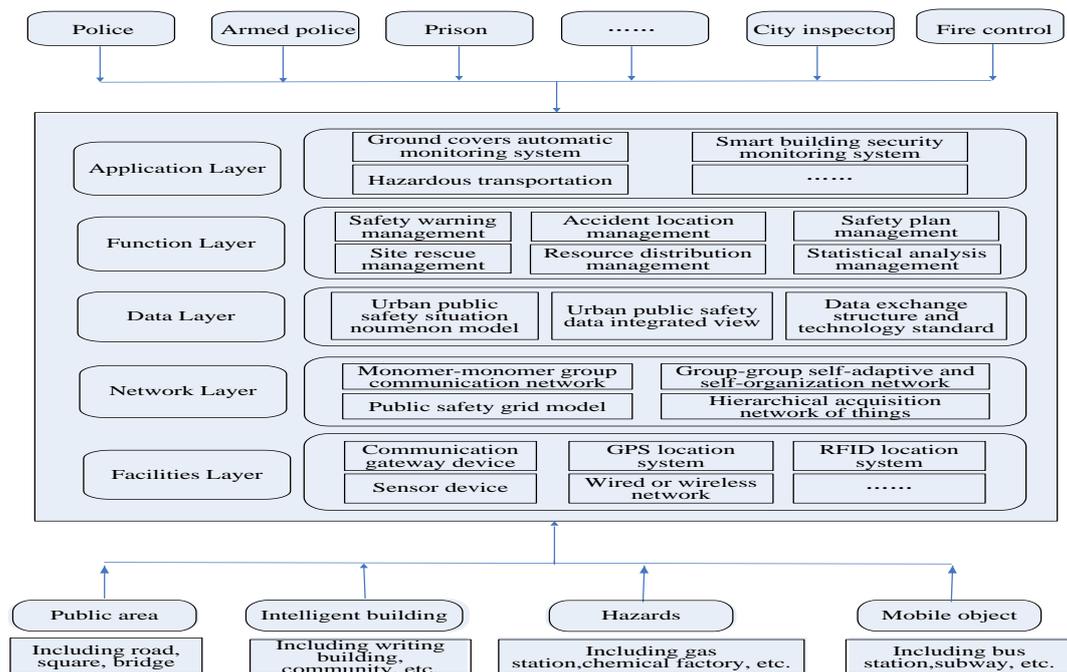


FIGURE 1 Intelligent urban public security management system structure

3 The key technology and method study

3.1 THE URBAN PUBLIC SAFETY DATA HIERARCHICAL COLLECTION NETWORK CONSTRUCTION TECHNOLOGY.

On the one hand, the urban public safety management environment is getting more and more complicated, such

as the typhoon and other natural disasters, the harmful gas leakage other safety accidents, both have all kinds of buildings distributed in the centre of the city where traffic flow is concentrated, and have bridges, and other public infrastructures distributed in the complex geological environment [11]. On the other hand, the complexity of urban safety management object may make different urban safety node data acquisition rate inconsistent.

Therefore, using conventional uniform method to deploy the sensor node may lead to inefficient of energy consumption of the sensor node in the region even premature failure and cause the urban public safety things united network disconnected or produce hollow. In addition, we found from practice that the data obtained from the monitoring of some adjacent sensors to the same environment factor from the same urban safety node. Therefore, in order to reduce energy consumption and improve the quality of the data communication, it is necessary to deal with the data comprehensively, which is monitored from multiple adjacent sensor nodes. According to the characteristics of urban public safety data information collection and transmission, this system using grid optimization method to division the urban public safety area, establish the urban public safety group, which support the communication between safety node within the scope of particular area. The urban public safety data collection network, which is based on the urban security node monomer-security groups and security zone, has the feature of self-adaptive self-organizing on data collection and transmission, and it supports the dynamic configuration of urban public safety data monitoring physical quantities and monitoring point. Among them, the safety data collection network sensor node cannot only realize the function of safe environment automatically data acquisition but also realize the function of forwarding and self-checking the safe data, support to send out the acquisition safety situation data. The safety data collection network structure based on grid division method, on one hand, puts forward a fascicles topology system which can minimize information transmission volume, reduces and evenly distribute node power consumption, suits for wireless sensor network, supports dynamic monitoring of multi-situation factors in urban public security environment, on the other hand, develops an urban public safety things networking grid partition algorithm which shows a special 3d layout and adapts to kinds of obstacles, satisfies regional connection and coverage of.

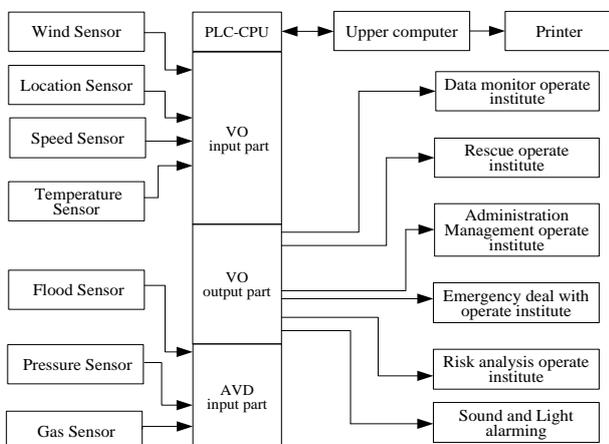


FIGURE 2 Urban public safety situation data acquisition network (1)

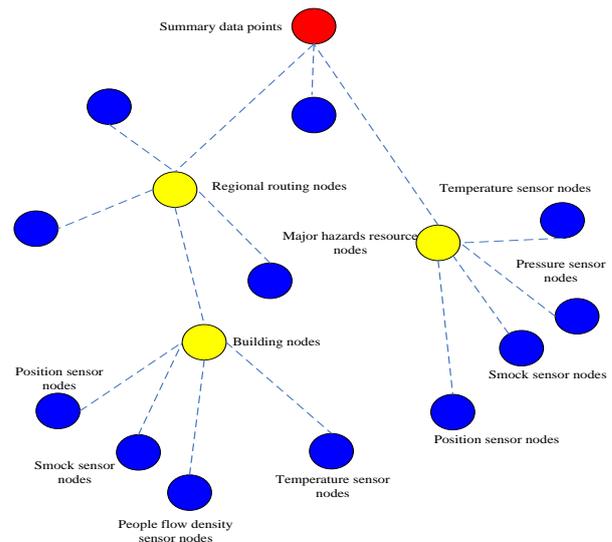


FIGURE 3 Urban public safety situation data acquisition network (2)

3.2 URBAN PUBLIC SAFETY SITUATION MODEL AND MANAGEMENT METHOD.

The situation is often used to describe a variety of internal and external environment information faced in the process of a physical activity. Urban public safety incident belongs to the typical unconventional emergencies; the situation information related to it the urban public safety incident occurred faced. The urban public security ontology model is an effective means to accurately describe or portray all kinds of complicated environment information the urban public safety management object faced. By constructing urban public safety situation ontology model the government can build urban public safety environment-public safety management object-public security resources mapping mechanism and accurate description all kinds of social attributes and real-time status information of the urban public safety management objects.

According to the content of the urban public security management object and the features of the urban public security incident decision-making, this paper will abstract summarize the urban public safety situation for rescue resources situation, the scene of the accident situation, surrounding risk situation three categories of situation factors. Among the three situations, the rescue resources situation refers to the resources situation, which can service urban public safety management object and is available for dispatch at the time of accident. The accident site situation is point to the indicator, which can describe the comprehensive state of urban public safety accident site, in order to make sure they are effective protected when accident occurred; the site staff situation, which reflects the space distribution of the victims and potential victims of the accident site. The surrounding risk situation refers to spatial distribution state and related information of the property, the staff and the dangerous source in 1km area around the scene of the accident [12].

According to the definition of urban public safety situation, the situation ontology model and the sample are showed as below. Among them, the relationship Subclass-of reflect the father and son relationship or inheritance relationship between different subclass in situation domain ontology, subclass situation can inherit his father situation properties and extension appropriately; the relationship Attribute-of reflect the affiliation between situation subclass concept and subclass attribute, the relationship Instance-of reflect the assignment type of a particular attribute of the subclass situation. When all of the attribute of a situation subclass have been assigned, you can get a group of assignment, which reflect the characteristics of this situation, called situation instance, the function create the situation subclass instance is called situation function. Obviously in order to realize the structure description of the situation, we need to create the situation function to structure deal with the distribution task situation. As follows:

3.3 THE TWO-WAY FEEDBACK MECHANISM AND KEY METHOD FOR SUPPORTING THE URBAN PUBLIC SAFETY INCIDENT EMERGENCY MANAGEMENT [11]

The two-way feedback system of urban public security management refers to in the process of dealing with the urban public safety incident, on the one hand, feedback all kinds of instruction information to scene of urban public safety accident by the internet of things system, like the emergency rescue instruction lamps in the high-rise buildings, to help the accident staff to conduct self-rescue; [13] On the other hand, tracking and monitoring the process status of the accident, collecting all kinds of process status data of the public safety accident site by remote start high performance wireless sensor equipment set up in the accident site, and then feedback to the urban public safety management system to guide the rescue teams to adjust and optimize the emergency rescue plan.

The system including four key feedback mechanisms and methods, as followed: the self-adaptive mechanism of safety intelligent management system, which is based on the two-way feedback of urban public safety data. Focus on researching the process data change model of all of the monitor nodes of urban public security internet of things, set the corresponding threshold, and start the emergency rescue terminal equipment. When the internet of things terminal equipment of original site suffered damage, it can research the urban public security internet of things emergency data collection system by applying the sequence cut method. The self-learning mechanism of safety intelligent management system, which based on the two-way feedback of urban public safety data. Its kernel is to design self-learning mechanism through CAS theory, so that the urban public security intelligent system can proceed self-learning and processing and form a new leaning experience which means the network structure and weight, according to the historical data of the safety

of things data centre and the processing state data of current safety incidents and apply the urban public security model and Bayes network. The self-adjustment mechanism of safety intelligent management system, which based on the two-way feedback of urban public safety data. Its corn is to generate the simulation matrix, apply the best projection direction and other method to evaluate the degree of the accident, and by use the orderly composite strategy of the maximal frequent item sets mining method over data stream, an improved clustering algorithm for dynamic data based on principal component analysis and density and other method for analysis and mining the state information of the accident site according to the five evolution processes and characteristics of the urban public accidents. The self-optimization mechanism of safety intelligent management system, which based on the two-way feedback of urban public safety data. Its corn is to realize automatic optimization of the urban security resource rescue plan based on SVM and finally find out the feasible technical route which can dissolve the urban accident resource rescue to support the self-optimize of the urban public security intelligence management plan, designing the Agent-DEVS model group which is the emergency rescue plan that can dissolve the urban accident and build the emergency resource rescue collaborative environment which is based on the HLA.

4 The positive research based on a certain company product

The design thought of this system has been preliminary reflected on the relevant prototype products in a certain information technology co., LTD. At present, related application cases are including Xinglin-Bay Business Parkis intelligent systems engineering, Zhejiang south lake prison security system, Sichuan environmental monitoring centre construction project monitoring and emergency command engineering project. Although the application fields have some differences, they both have innovations below. Support the management of monitoring and pre-warning urban safety hazards. Improve the level of alarming, monitoring, pre-warning and supervision through establishing the system of hazards data collecting and monitoring. Support the collection and track the safety data network. Combine next-generation internet and wireless sensor network together, and connect urban management departments at various levels, each unit grid and each city parts. Support intelligent dispatch of security rescue. The results of this project can realize remote emergency command dispatching within GIS, integrated positioning system, signal monitor system and GWSN [14].

Take the development of a city construction safety management platform by demonstration application units as an example. This platform takes the grid management method, marks the important building, which may occur safety accident within the scope of management area as

different types of urban public security node, builds the city public safety data acquisition network by modern information technology. Combined with the actual demand of urban public security management and monitoring, the urban safety management grid is divided into business grid and geographic grid in the implementation process of demonstration project. Imaginary arcs represent the logical correspondence between business grid and geographic grid.

On this basis, Project has proposed and implemented urban public security management platform architecture,

basing grid management. This platform adopts the hybrid network design of three video networking structure and analogy digital video, and makes full use of existing mature wired/ wireless technology, achieves real-time acquisition and analysis of urban public safety data, realizes urban public security management tasks of urban public safety data exchange, intelligence warning and analysis of security incidents, security incidents intelligent rescue and disposal [15]. As follows

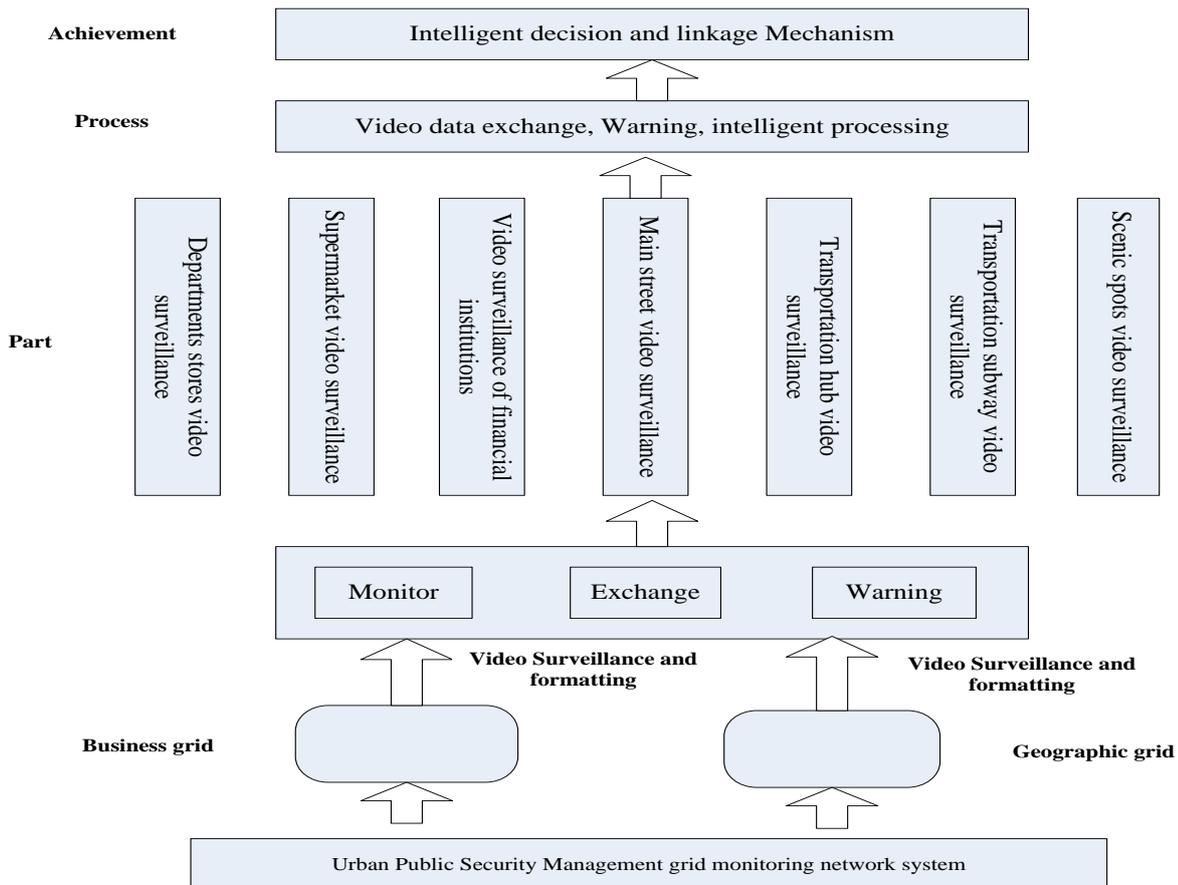


FIGURE 4 Urban public security management platform architecture

Among this, urban public security event early warning divides two parts, first is establishing early warning process, which includes finding urban security alert, seeking security event source, analysing security situation, confirming security event importance and starting alarming. Second is developing a comprehensive index to measure the total alert degree through the establishment of monitoring index system. Meanwhile, divide the alert interval into five areas, safety area, light warning area, moderate warning area, serious warning area and severe warning area, arranging the corresponding early warning plan aimed at every area, the details see Figure 6. Urban public security event linkage disposal and rescue command management. Adopting the model of receive unified, dispose classified, large alarm

system, establishing an unified command scheduling management system which is oriented by first class monitoring command centre, supported by second and third class monitoring centre [16]. This system includes receiving and disposing command scheduling module based on computer network, wired and wireless communications and other systems, rescue information repository supported by inputting, maintaining, updating, sharing and dispatching the urban public security event disposal method, realizing functional feedback between safety incident site and command management centre by all kinds of Internet of things technology, and also proceeding rescue command management system of urban public security event intelligent disposal, the details see Figure 7.

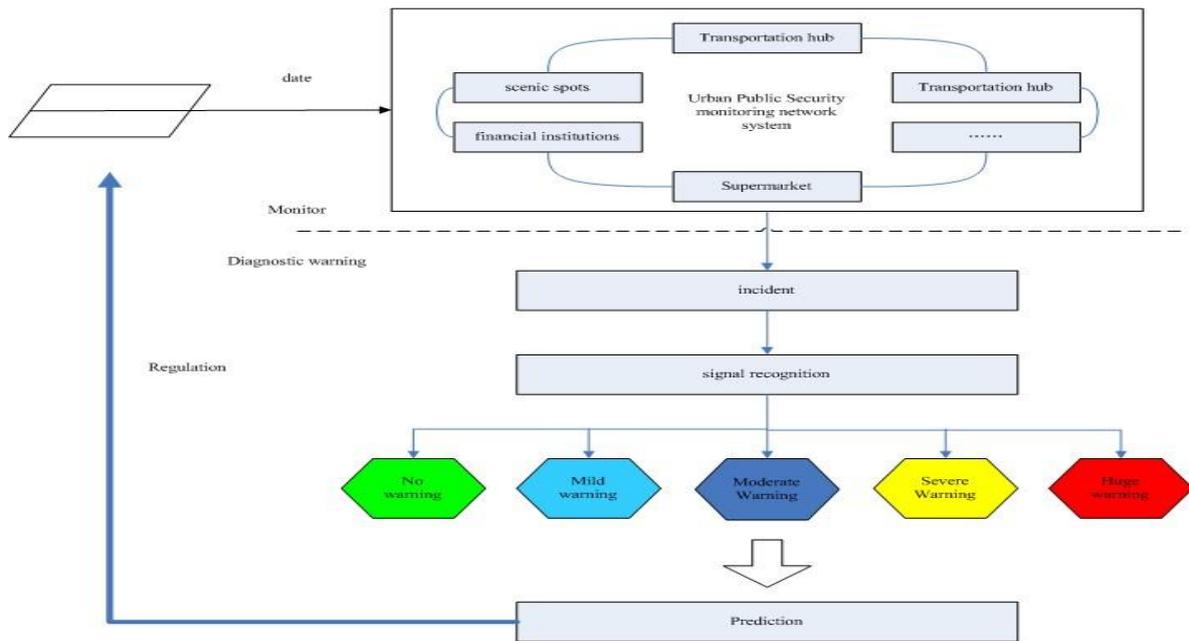


FIGURE 5 Urban public security event early warning model

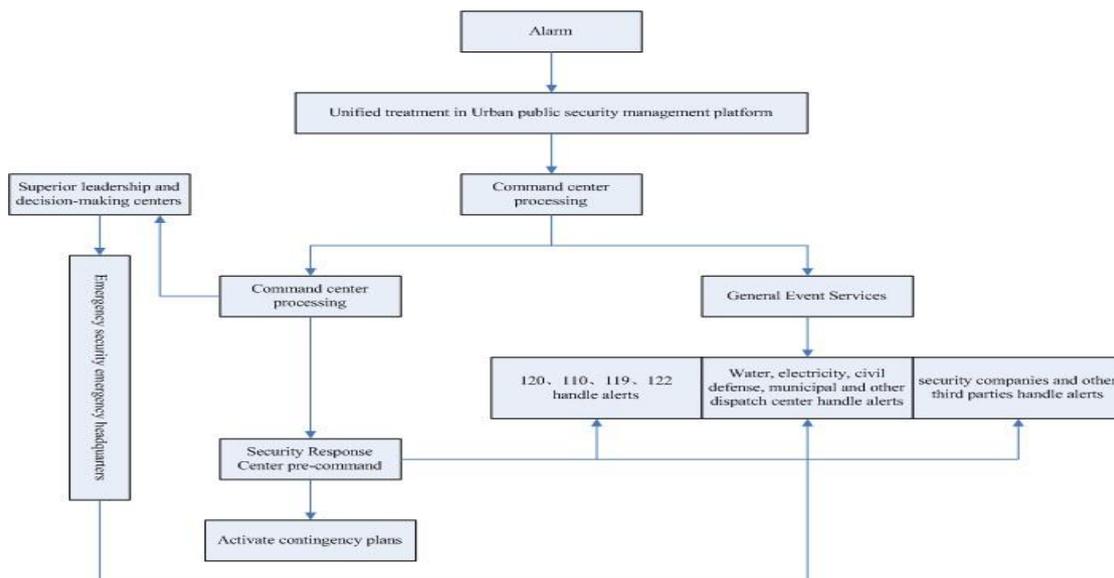


FIGURE 6 Urban public security event linkage disposal and rescue command management model

5 Conclusions

According to the demand and characteristic of urban public safety management, this paper put forward smart urban public safety management system, which is fit in urban security situation. The target is to establish an urban public safety intelligent management system, which is including data collecting of Internet of things security, safety situation ontology, security data exchange, security emergency management and security data analysis. Then we mainly put forward and studied urban safety data stratified hierarchical collection of Internet of things which is based on monomer- group-region grid structure, safety situation ontology model which support normalized description of urban security resources and

management object in complex environment, handling mechanism of self-adaptive-study-adjust-optimize which support urban public safety complex event emergency management. This system can not only help prevent urban public security incident from occurring, but also understand the security incident spot situation. Besides, it can also help improving public security incident.

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