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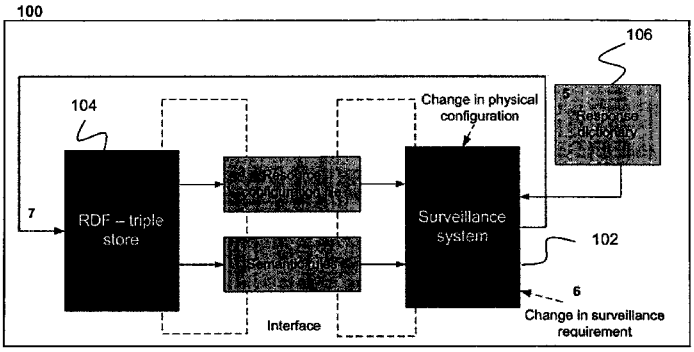



FIG. 1

(57) Abstract: The present invention provides a system for providing interface for real time surveillance having a plurality of data resources and at least one Resource Description Framework (RDF) comprising at least one rule-based engine, at least one surveillance system and at least one response dictionary. Further the present invention provides a method for providing interface for real-time surveillance. The method comprising steps of creating surveillance ontology, creating semantic rules for decision making, providing link to form relationship between resources and to differentiate resources, assigning machine readable instructions for detection rules and accessing resource configuration file and rule files in surveillance system. The method for assigning machine readable instructions for detection rules further comprises creating equivalent triples for surveillance ontology, extracting triples information and arranging triples information into RDF format triples, processing RDF triples into variable title and data and providing configuration file in readable format to be used by surveillance system.

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# A SYSTEM AND METHOD FOR PROVIDING INTERFACE FOR REAL-TIME SURVEILLANCE

## FIELD OF INVENTION

The present invention relates to a system and method for providing interface for Real-Time Surveillance through online-offline processing flows which utilizes semantic technology.

## BACKGROUND ART

The available surveillance system does not provide effective solution for the increasing needs of security which poses public safety as the main concern. Semantic technology has the ability to add, change, and create relationship by just changing the shared external model program. Semantic technology can be used in surveillance system to provide some level of intelligence and flexibility. The disadvantage of the semantic technology is that it could slow down process and affect real-time performance of surveillance application as it involves search and response time.

Therefore, in the present invention, real-time surveillance system is separated into two parts wherein surveillance functions (i.e. object detection) involves image processing and is in real time while situational information is stored in Resource Description Framework (RDF) format using semantics application. Surveillance functions and situational information are linked with configuration file. The structural situational information of the environment enables real-time processing for surveillance applications and has the ability to be managed by user without affecting overall process flow of the surveillance system in the present invention.

As surveillance functions and situational information are built separately, a change in surveillance functions such as processing and detection method will enable online flowchart to be updated. Simultaneously, a situational change will cause Resource Description Framework (RDF) or semantic applications to be updated.

The approach in the present invention has the ability to utilize flexibility available in semantics to manage or organize information and real-time reading compatibility of surveillance in interpreting situational information of environment. Flexible architecture for real-time surveillance system is provided using Resource Description Framework (RDF) and RDF triples as inputs. Reconfiguration capability is provided in surveillance system whenever there is a change in resources.

The subject matter claimed herein is not limited to embodiments that solve any disadvantages or that operate only in environments such as those described above. Rather, this background is only provided to illustrate one exemplary technology area where some embodiments described herein may be practice.

## SUMMARY OF INVENTION

The present invention provides a system (100) for providing interface for real-time surveillance having a plurality of data resources and at least one Resource Description Framework (RDF) storage (104) comprising at least one rule-based engine, at least one surveillance system (102) and at least one response dictionary (106). The said rule-based engine creates semantic rules for decision making while the said Resource Description Framework (RDF) storage (104) and the said response dictionary (106) stores configuration file and response of machine readable instructions.

Another aspect of the present invention provides a method (1200) for providing interface for real-time surveillance. The method comprising steps of creating surveillance ontology (902, 1202), creating semantic rules for decision making (904, 1204), providing link to form relationship between resources and to differentiate resources (906, 1206) wherein resources includes video camera and microphone, assigning machine readable instructions for detection rules (1208) and accessing resource configuration file and rule files in surveillance system.

Preferably, the method for creating surveillance ontology further comprises detailing relationship between resources to set up configuration of surveillance system. Further the method for providing link to form relationship between resources and to differentiate resources further comprises assigning and linking predicate of RDF triples.

Another aspect of the present invention provides a method for assigning machine readable instructions for detection rules. The method comprises creating equivalent triples for surveillance ontology (908, 1210), extracting triples information and arranging triples information into RDF (resource, predicate and data format) triples (910, 1212), processing RDF triples into variable title and data (912, 1214) and providing configuration file in readable format to be used by surveillance system (914,1216).

A further aspect of the present invention provides a further method for assigning machine readable instructions for detection rules. The method comprises creating equivalent triples for surveillance ontology (1218), extracting all permutation and

assigning code to each event to produce semantic rule file (1220) and creating and storing response to response dictionary to be used by surveillance system (1222).

Another aspect of the present invention provides a method for accessing resource configuration file and rule files in surveillance system. The method comprises opening resource configuration file or semantic rule file or response semantic rule file (1302, 1304, 1306), reading data from known data variables (1308), reading rules and applying condition in detection module (1310), initializing variable and configuration (1312) and displaying image based on acquired image (1314).

The present invention consists of features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

## BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

To further clarify various aspects of some embodiments of the present invention, a more particular description of the invention will be rendered by references to specific embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the accompanying drawings in which:

FIG. 1 illustrates architecture of Real-Time Surveillance System.

FIG. 2 illustrates Graphical representation of Surveillance Ontology.

FIG. 3 provides example of Semantic Rules.

FIG. 4 illustrates linked predicate between resources.

FIG. 5 illustrates example of using Attribute Grammars (AG) to add and remove triple in AG.

FIG. 6 illustrates outcome of the triple store extracted using Semantic Query.

FIG. 7 illustrates result of the formatted variables.

FIG. 8 illustrates configuration file loaded into surveillance system.

FIG. 9 is a flowchart illustrating method providing interface for real-time surveillance by generating Resource Configuration File.

FIG. 10 illustrates a surveillance resource permutation files generation.

FIG. 11 illustrates a surveillance rule permutation files generation.

FIG. 12 illustrates methodology of real-time surveillance system.

FIG. 13 is a flowchart illustrating method for accessing resource configuration file and rule files in surveillance system.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a system and method for providing interface for Real-Time Surveillance through online-offline processing flows which utilizes semantic technology. Hereinafter, this specification will describe the present invention according to the preferred embodiments. It is to be understood that limiting the description to the preferred embodiments of the invention is merely to facilitate discussion of the present invention and it is envisioned without departing from the scope of the appended claims.

Reference is first made to FIG. 1. FIG. 1 illustrates architecture of Real-Time Surveillance System. As illustrated in FIG. 1, the system (100) for providing interface for real-time surveillance having a plurality of data resources and at least one Resource Description Framework (RDF) storage (104) comprising at least one rule-based engine, at least one surveillance system (102) and (104) and at least one response dictionary (106). The rule-based engine creates semantic rules for decision making while the Resource Description Framework (RDF) storage (104) and the said response dictionary (106) stores configuration file and response of machine readable instructions.

Reference is now made to FIGs. 9 and 12 with further reference to FIGs. 2, 3, 4, 5, 6, 7 and 8. FIG. 9 is a flowchart illustrating method providing interface for real-time surveillance by generating Resource Configuration File while FIG. 12 illustrates methodology of real-time surveillance system. As illustrated in FIG. 9 and FIG. 12 respectively, a method (900,1200) for providing interface for real-time surveillance comprising steps of creating surveillance ontology (902,1202). Graphical representation of Surveillance Ontology is illustrated in FIG. 2 and the method for creating surveillance ontology further comprises detailing relationship between resources to set up configuration of surveillance system. Thereafter, semantic rules for decision making is created (904, 1204) wherein FIG. 3 provides example of semantic rules. Subsequently, link is provided to form relationship between resources and to differentiate resources (906, 1206) by assigning and linking predicate of Resource Description Framework (RDF) triples. The said resources include video camera and microphone. For example, linked predicate (i.e. an IP address) is assigned and is added between resources through recognizable format of semantics application to differentiate relationship between resources (camera 1) of line in between nodes of IP addresses. Linked

predicate is used to declare relationship between resources using recognizable format by semantic application in Real-Time Surveillance System.

Thereafter, machine readable instructions are assigned for detection rules (1208). The method for assigning machine readable instructions for detection rules further comprises creating equivalent triple for surveillance ontology (908, 1210). FIG. 5 illustrates example of using Attribute Grammars (AG) to add and remove triple in AG. Semantic query is used to list triple is predefined manner from centre of the tree as illustrated in FIG. 5. Semantic query is used to obtain or manipulate data on database without knowing its detailed syntactic structure.

Information of triples is extracted and arranged into RDF (resource, predicate and data format) triples (910, 1212). FIG. 6 illustrates outcome of the triple store extracted using Semantic Query. RDF triples are processed into variable title and data (912, 1214) as illustrated in FIG. 7. RDF triples are processed into variable title and data by combining resource and predicate into single resource variable and assigning data to the said resource variable. Thereafter, configuration file is provided in readable format to be used by surveillance system (914, 1216). FIG. 8 illustrates configuration file loaded into surveillance system.

A further method for assigning machine readable instructions for detection rules further comprises creating equivalent triples for surveillance ontology (1218) and extracting all permutation and assigning code to each event to produce semantic rule file (1220). FIG. 10 illustrates a surveillance resource permutation files generation while FIG. 11 illustrates a surveillance rule permutation files generation. Semantic rule defines representation of cameras and their number in a machine readable manner. For example, if the total number of cameras is 8, it can be represented by a byte and a specific decimal code can be applied to the situation. If an object appears in cameras 1 and 7, it is represented by the code 130. The real-time surveillance system will respond to code 130 and the corresponding definition of 130 can be found in the response dictionary.

and creating and storing response to response dictionary to be used by surveillance system (1222).

Semantic permutation files are generated for semantic rule information extractions. Semantic permutation files generation will generate file by defining the resources in a machine readable way. For example, if the total number of cameras is 8, it can be represented by a byte and a specific decimal code (also called base ten) can be applied to represent the situation.

Decimal = $2^n$

n=m-1

where m represents the numbers of camera

$128 = 2^7 \Rightarrow 0000\ 0000_B$

As illustrated in FIG.11, camera permutation code 130 represents Camera 1 and Camera 7. Real-time surveillance system will respond to Camera Permutation code 130 when objects are detected from these two cameras. The 130 definition can be found in the response dictionary, and the location of the cameras is at Region 1: Close to lobby area and the exit is North door N1. When Microphone 1 (M1) detects a signal, the real-time surveillance system will respond to code Microphone detection action code 130. The code 130 has been defined to refer to Camera 1 and Camera 7 to detect any object within the Region 1: Close to lobby area and the exit is North door N1.

Reference is now being made to FIG. 13. FIG. 13 is a flowchart illustrating method for accessing resource configuration file and rule files in surveillance system. As illustrated in FIG. 13, resource configuration file and rule files in surveillance system is access by opening resource configuration file or semantic rule file or response semantic rule file (1302, 1304, 1306). Thereafter, data from known data variables (1308) is read. Subsequently, rules are read and condition in detection module is applied (1310). Upon applying condition in detection module variable and configuration are initialized (1312). Image is displayed based on acquired image (1314).

The system and methodology of the present invention has the ability to utilize flexibility available in semantics to manage or organize information and real-time reading

compatibility of surveillance in interpreting situational information of environment. Flexible architecture for real-time surveillance system is provided using Resource Description Framework (RDF) and RDF triples as inputs. Reconfiguration capability is provided in surveillance system whenever there is a change in resources.

As surveillance functions and situational information are built separately, a change in surveillance functions such as processing and detection method will enable online flowchart to be updated. Simultaneously, a situational change will cause Resource Description Framework (RDF) or semantic applications to be updated in the present invention.

The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their scope.

## CLAIMS

1. A system (100) for providing interface for real-time surveillance having a plurality of resources and at least one Resource Description Framework (RDF) storage (104) comprising:
   at least one rule-based engine;
   at least one surveillance system (102); and
   at least one response dictionary (106).

2. A system according to Claim 1, wherein the said rule-based engine creates semantic rules for decision making.

3. A system according to Claim 1, wherein the said Resource Description Framework (RDF) storage (104) and the said response dictionary (106) stores configuration file and response of machine readable instructions.

4. A method (900,1200) for providing interface for real-time surveillance comprising steps of:
   creating surveillance ontology (902,1202);
   creating semantic rules for decision making (904,1204);
   providing link to form relationship between resources and to differentiate resources (906,1206);
   assigning machine readable instructions for detection rules (1208); and
   accessing resource configuration file and rule files in surveillance system.

5. A method according to Claim 4, wherein creating surveillance ontology further comprises detailing relationship between resources to set up configuration of surveillance system.

6. A method according to Claim 5, wherein resources includes video camera and microphone.

7. A method according to Claim 4, wherein providing link to form relationship between resources and to differentiate resources further comprises assigning and linking predicate of RDF triples.

8. A method according to Claim 4, wherein assigning machine readable instructions for detection rules further comprises:

creating equivalent triples for surveillance ontology (908,1210);

extracting triples information and arranging triples information into RDF (resource, predicate and data format) triples (910,212);

processing RDF triples into variable title and data (912,1214); and

providing configuration file in readable format to be used by surveillance system (914,1216).

9. A method according to Claim 4, wherein assigning machine readable instructions for detection rules further comprises:

creating equivalent triples for surveillance ontology (1218);

extracting all permutation and assigning code to each event to produce semantic rule file (1220); and

creating and storing response to response dictionary to be used by surveillance system (1222).

10. A method according to Claim 8, wherein processing RDF triples into variable title and data further comprises:

combining resource and predicate into single resource variable; and

assigning data to the said resource variable.

11. A method according to Claim 4, wherein accessing resource configuration file and rule files in surveillance system further comprises:

opening resource configuration file or semantic rule file or response semantic rule file (1302, 1304, 1306);

reading data from known data variables (1308);

reading rules and applying condition in detection module (1310);

initializing variable and configuration (1312); and

displaying image based on acquired image (1314).

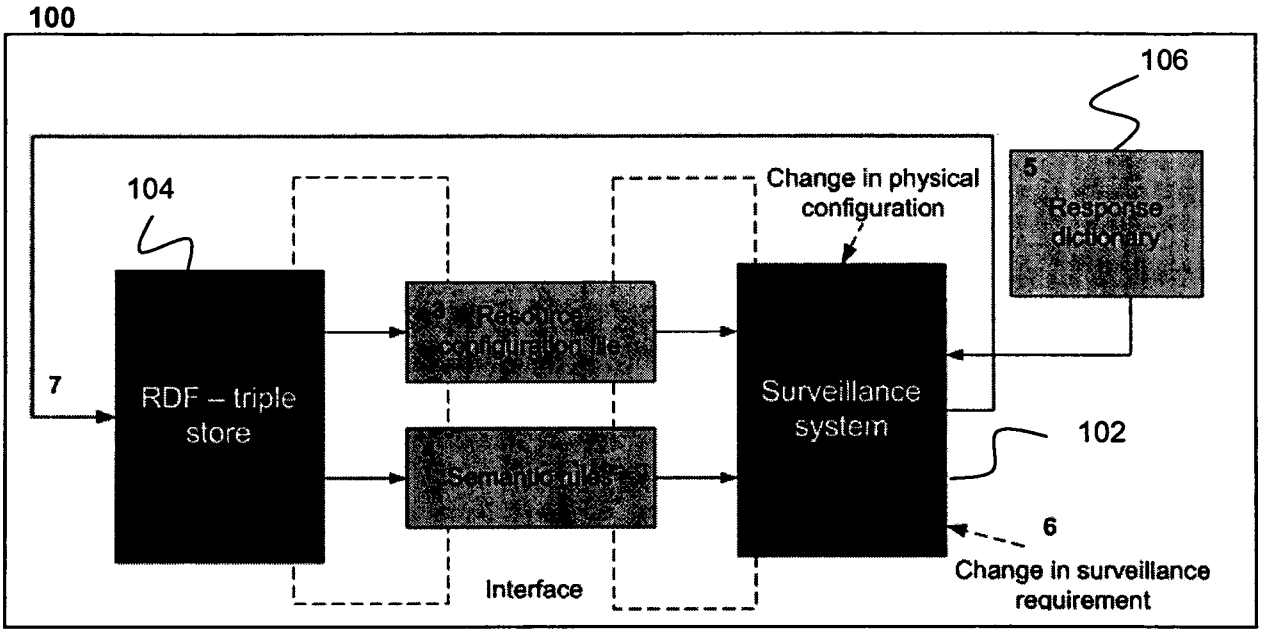

100
106
104
Change in physical configuration
5
Response dictionary
7
RDF – triple store
Surveillance system
102
6
Change in surveillance requirement
Interface

FIG. 1

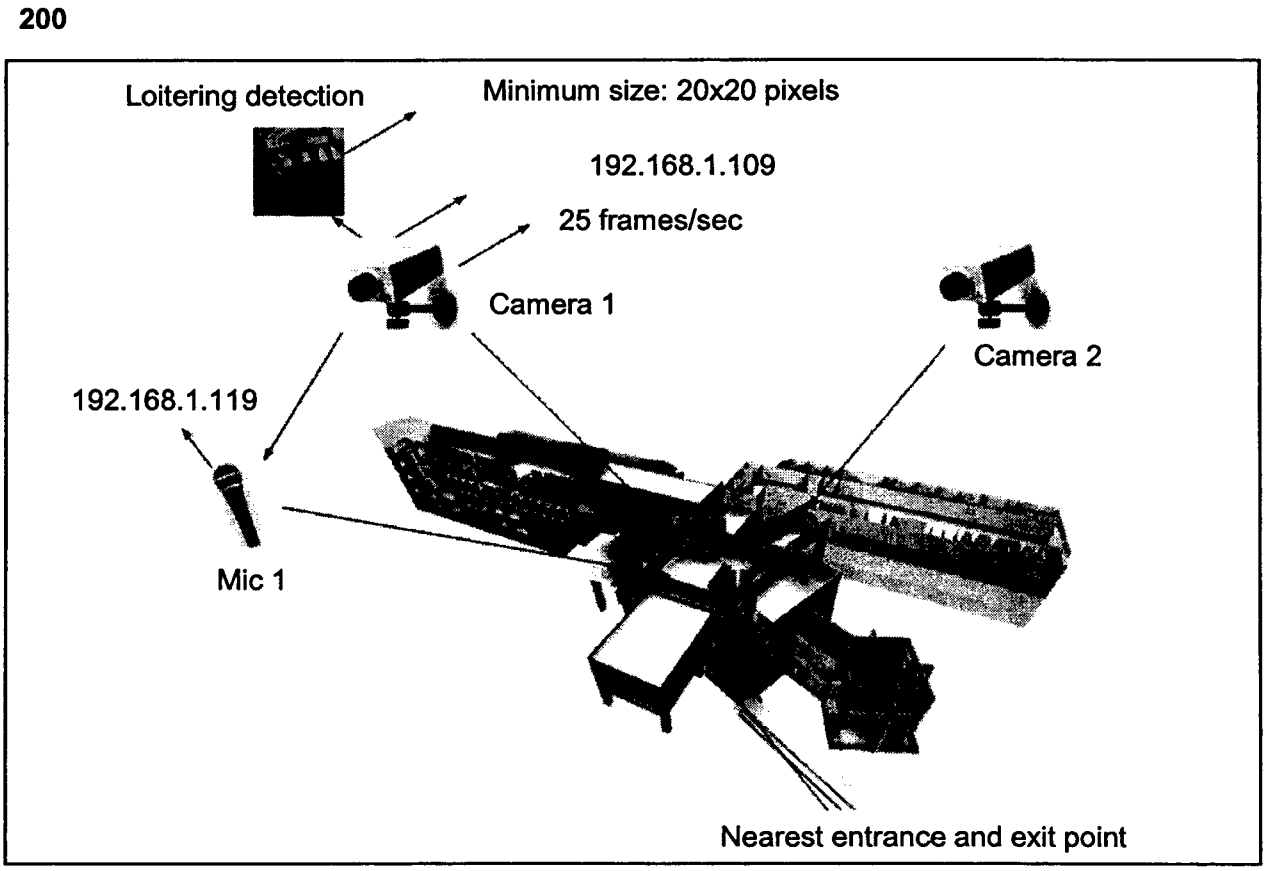

200
Loitering detection
Minimum size: 20x20 pixels
192.168.1.109
25 frames/sec
Camera 1
Camera 2
192.168.1.119
Mic 1
Nearest entrance and exit point

FIG. 2

300

| | |
|---|---|
| **Semantic rules** | If visible in camera 1 and visible in camera 2 = location = Lobby<br>If microphone 1 detected signal pulse turn on camera 1, camera 2 and camera 7 |

FIG. 3

400

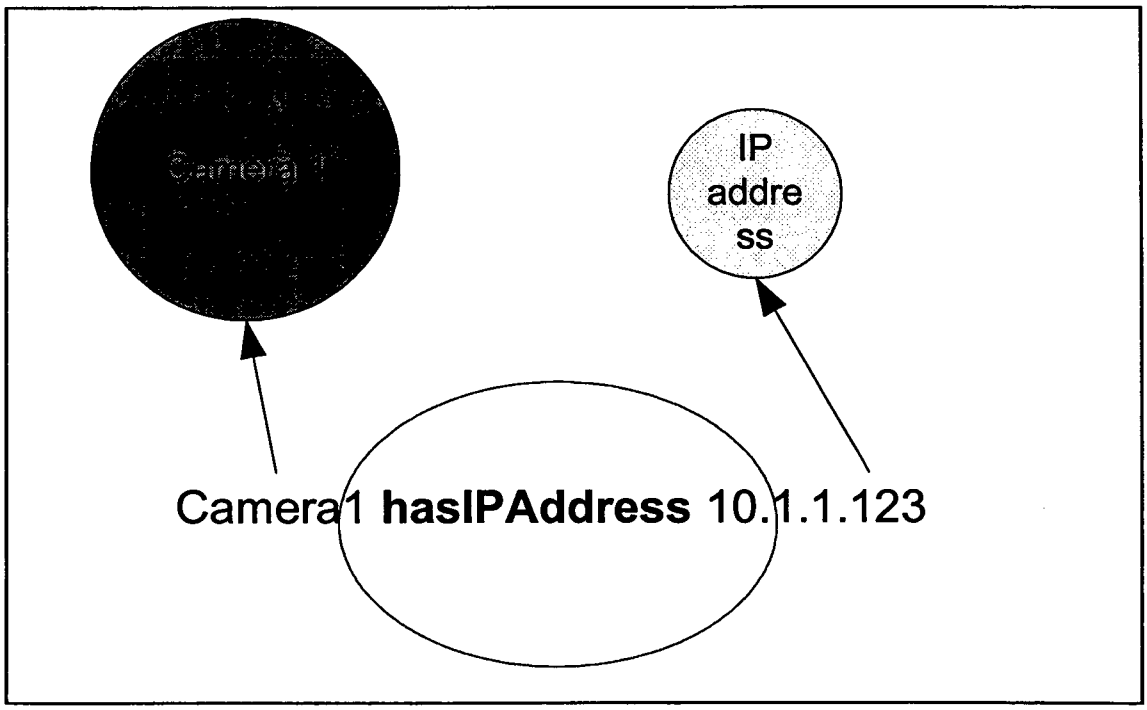



FIG. 4

500

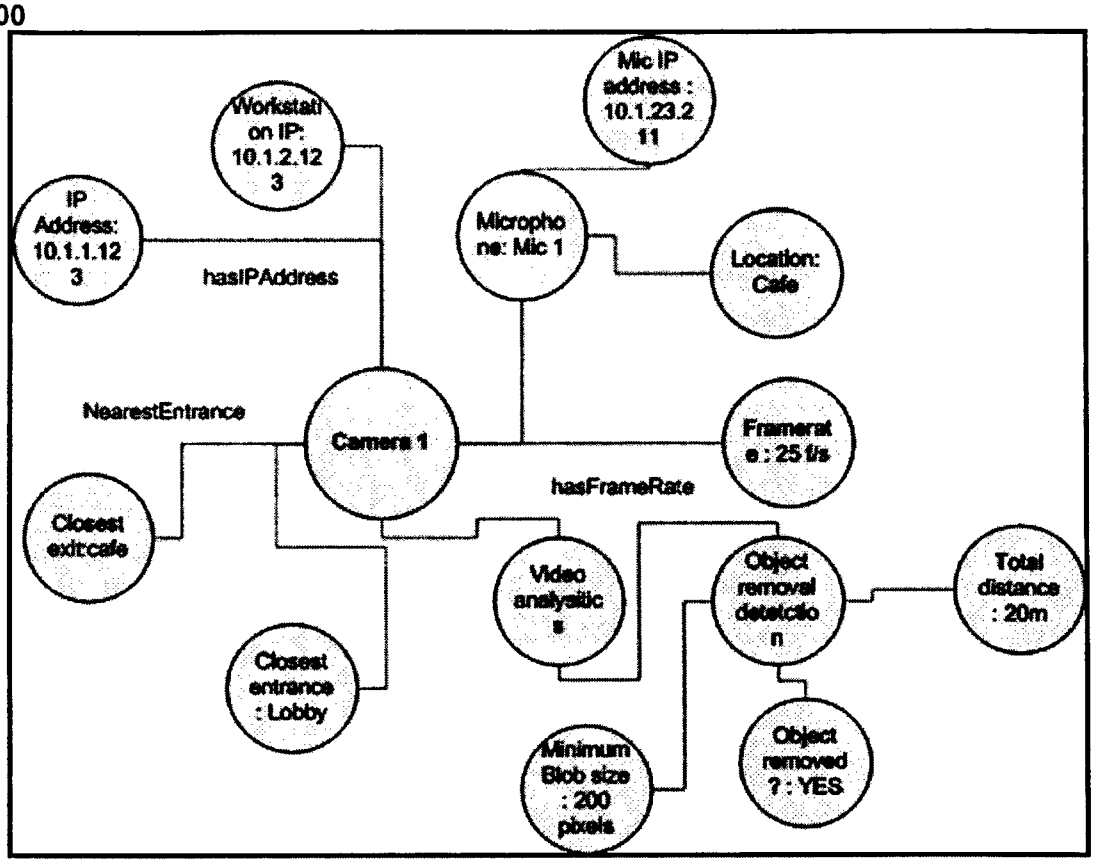



FIG. 5

600

| | | |
|---|---|---|
| Camera1 | hasFrameRate | 25 |
| Camera1 | nearestEntrance | LobbyDoor |
| Camera1 | useVideoAnalytic | VA#1 |
| Camera1 | hasIPAddress | 10.1.25.1 |
| Camera1 | useVideoAnalytic | VA#1 |
| Camera1 | hasDisplayRes | 1024x768 |
| Camera1 | hasLocation | Lobby |
| Camera1 | hasMicrophone | Mic1 |
| Mic1 | hasLocation | Lobby |
| Mic1 | hasIPAddress | 10.1.25.6 |
| Mic1 | nearestEntrance | LobbyDoor |
| VA#1 | hasSettingA | 300 |
| VA#1 | hasSettingB | 100 |
| VA#1 | hasOutputAObjectID | |
| VA#1 | hasOutputBEvent | |
| VA#1 | hasOutputC | Features |

FIG. 6

700

| | |
|---|---|
| Camera1_hasFrameRate | 25 |
| Camera1_nearestEntrance | LobbyDoor |
| Camera1_useVideoAnalytic | VA#1 |
| Camera1_hasIPAddress | 10.1.25.1 |
| Camera1_useVideoAnalytic | VA#1 |
| Camera1_hasDisplayRes | 1024x768 |
| Camera1_hasLocation Lobby | |
| Camera1_hasMicrophone | Mic1 |
| | |
| Mic1_hasLocation | Lobby |
| Mic1_hasIPAddress | 10.1.25.6 |
| Mic1_nearestEntrance | LobbyDoor |
| VA#1_hasSettingA | 300 |
| VA#1_hasSettingB | 100 |
| VA#1_hasOutputA | ObjectID |
| VA#1_hasOutputB | Event |
| VA#1_hasOutputC | Features |

FIG. 7

800

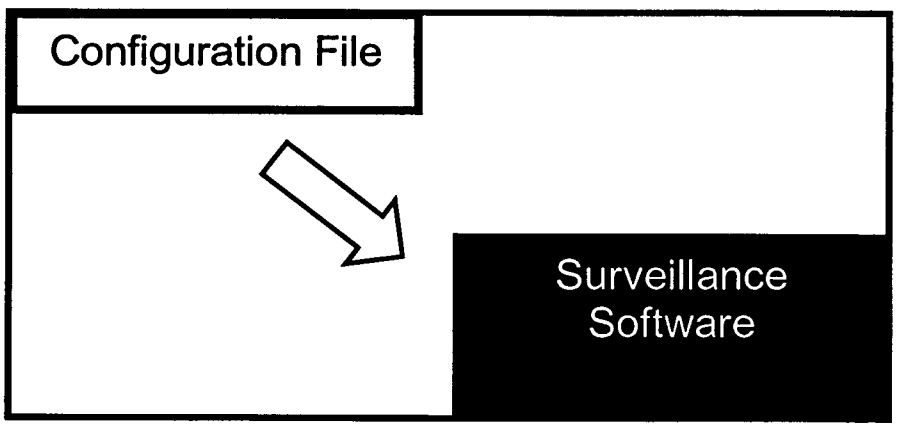



FIG. 8

900

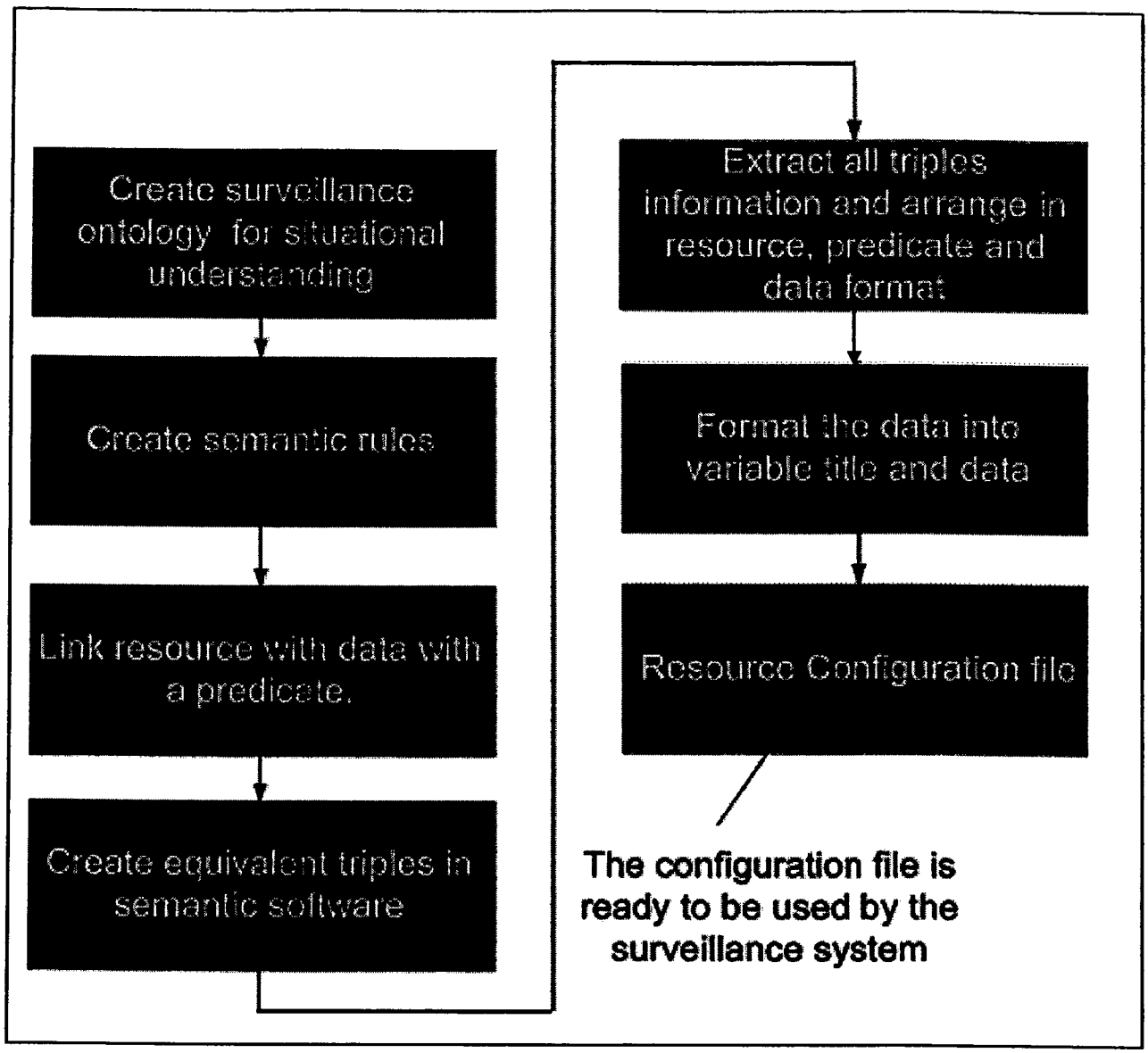

Create surveillance ontology for situational understanding
Create semantic rules
Link resource with data with a predicate.
Create equivalent triples in semantic software
Extract all triples information and arrange in resource, predicate and data format
Format the data into variable title and data
Resource Configuration file
The configuration file is ready to be used by the surveillance system

FIG. 9

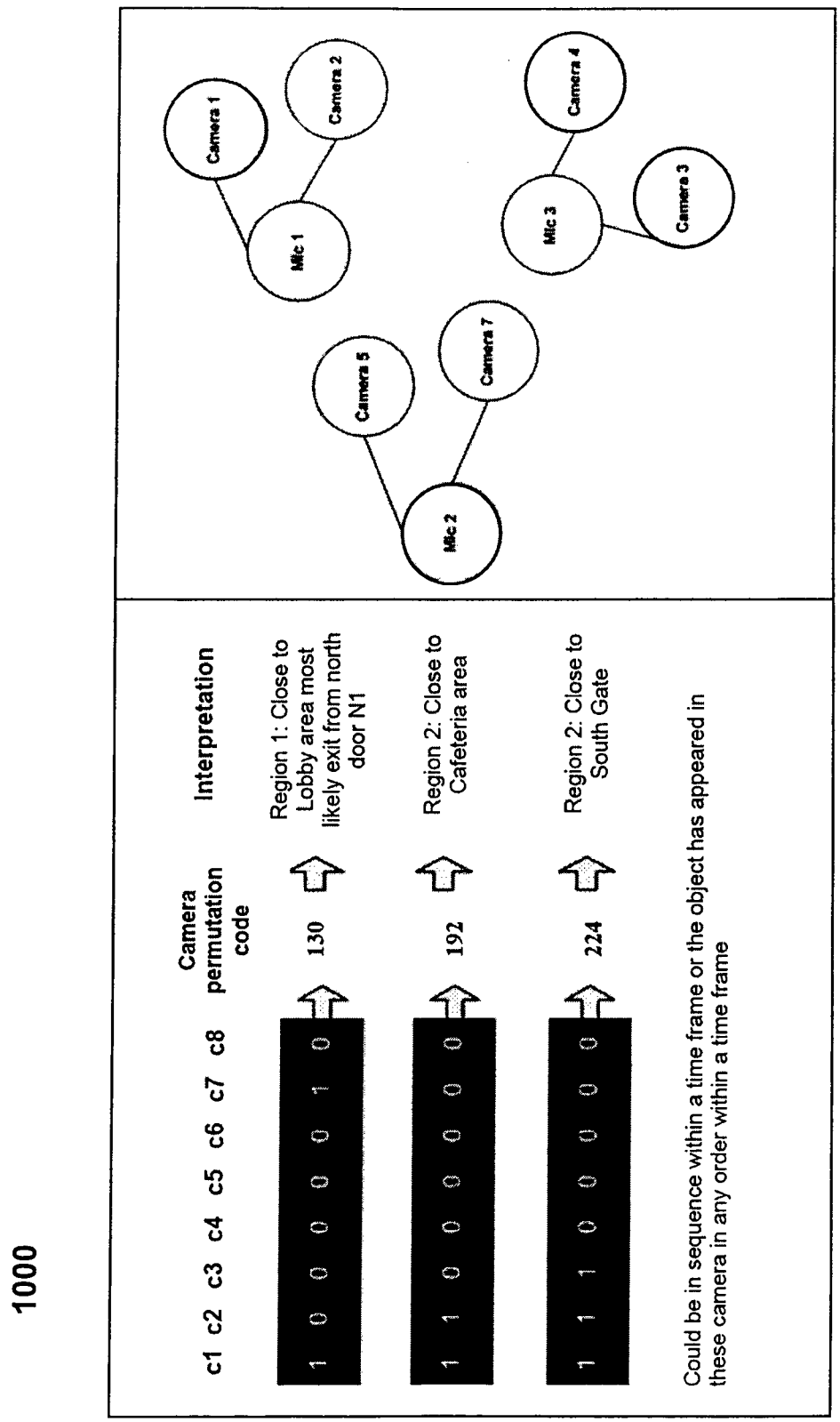

1000
c1 c2 c3 c4 c5 c6 c7 c8
Camera permutation code
Interpretation
1 0 0 0 0 0 1 0
130
Region 1: Close to Lobby area most likely exit from north door N1
1 1 0 0 0 0 0 0
192
Region 2: Close to Cafeteria area
1 1 1 0 0 0 0 0
224
Region 2: Close to South Gate
Could be in sequence within a time frame or the object has appeared in these camera in any order within a time frame
Camera 1
Camera 2
Mic 1
Camera 5
Camera 7
Mic 2
Camera 4
Mic 3
Camera 3

FIG. 10

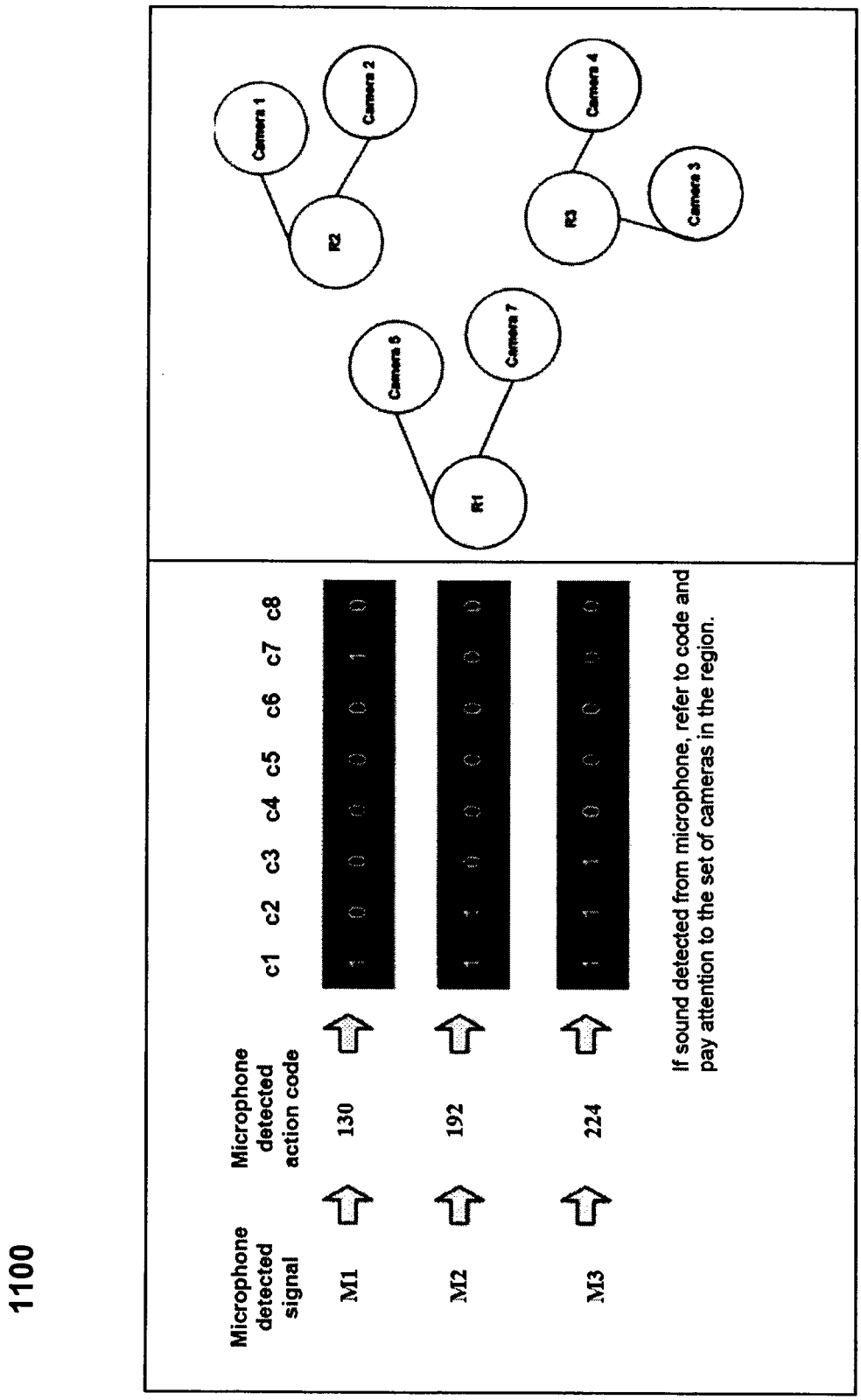

1100
Microphone detected signal
Microphone detected action code
c1 c2 c3 c4 c5 c6 c7 c8
M1
130
M2
192
M3
224
If sound detected from microphone, refer to code and pay attention to the set of cameras in the region.
Camera 1
Camera 2
R2
Camera 4
Camera 3
R3
Camera 6
Camera 7
R1

FIG. 11

1200

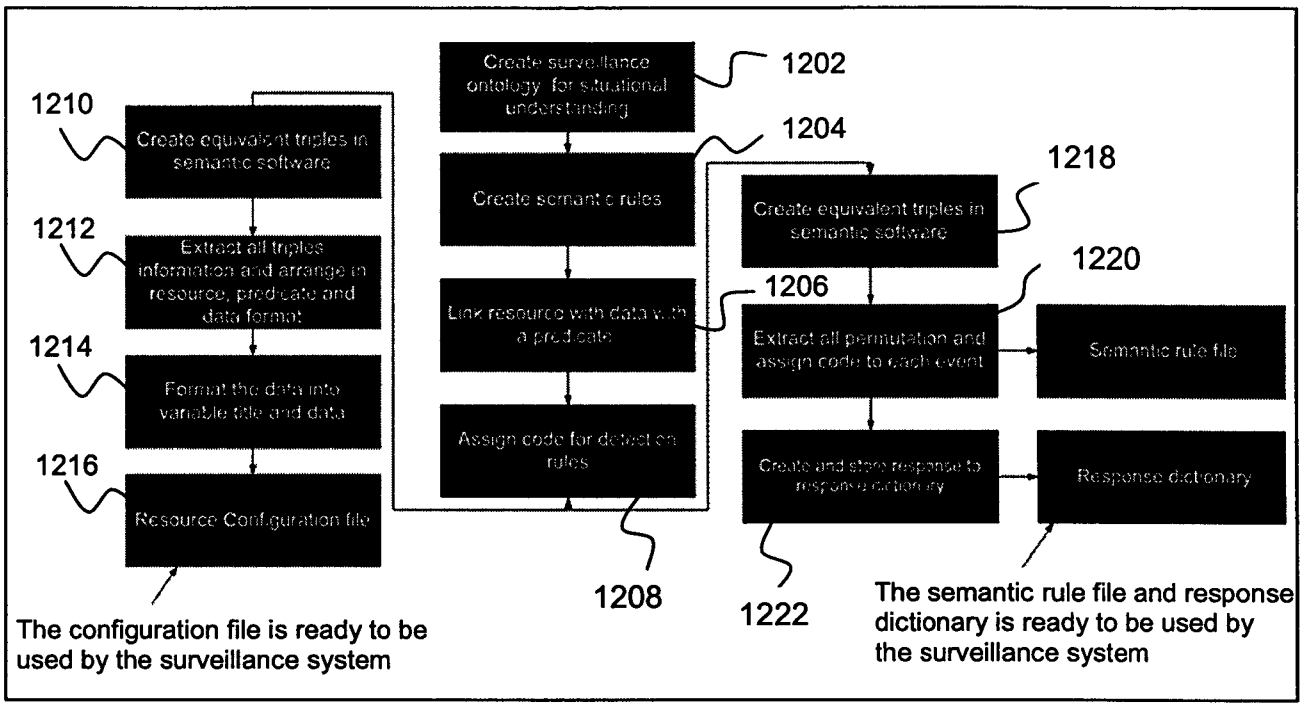

Create surveillance ontology for situational understanding
1202
1204
Create semantic rules
Link resource with data with a predicate
1206
Assign code for detection rules
1208
1210
Create equivalent triples in semantic software
1212
Extract all triples information and arrange in resource, predicate and data format
1214
Format the data into variable title and data
1216
Resource Configuration file
The configuration file is ready to be used by the surveillance system
1218
Create equivalent triples in semantic software
1220
Extract all permutation and assign code to each event
Semantic rule file
Create and store response to response dictionary
Response dictionary
1222
The semantic rule file and response dictionary is ready to be used by the surveillance system

FIG. 12

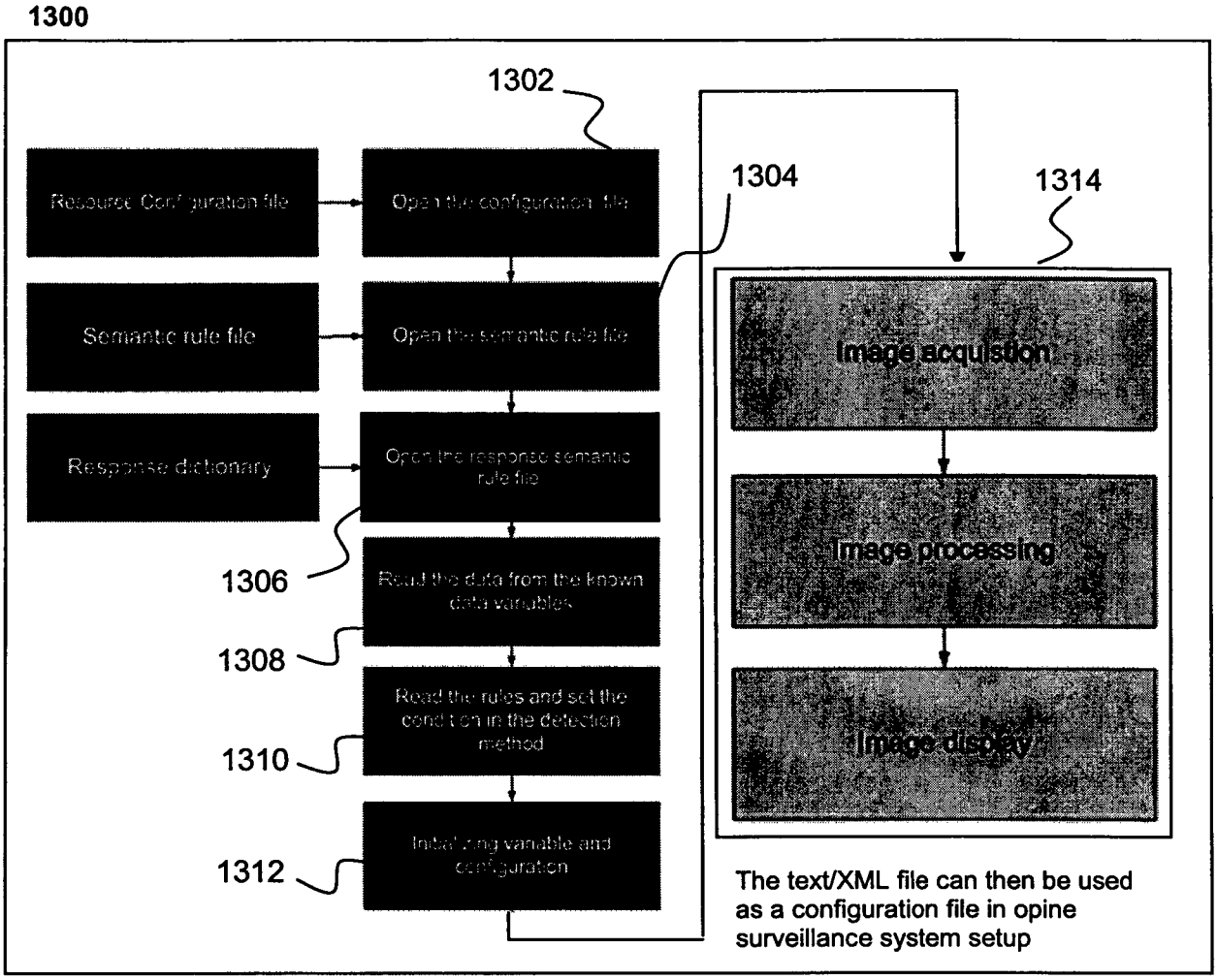

1300
1302
1304
1314
Resource Configuration file
Open the configuration file
Semantic rule file
Open the semantic rule file
Response dictionary
Open the response semantic rule file
1306
Read the data from the known data variables
1308
Read the rules and set the condition in the detection method
1310
Initializing variable and configuration
1312
Image acquisition
Image processing
Image display
The text/XML file can then be used as a configuration file in opine surveillance system setup

FIG. 13

**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/MY2011/000161**

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

***G08B 13/196*** (2006.01); ***G06f 17/00*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI and EPODOC and keywords: semantic technology, rule engine, surveillance systems , real time monitoring and like terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | Poppe, C. et al., 'Semantic web technologies for video surveillance metadata', Multimedia Tools Appl, published on 14 September 2010<br>Whole document especially see (Section 1-Introduction, section 3.2 Semantic metadata model -5.3 dynamic reconfiguration) | 1-11 |
| A | US 2005/0055330 A1 (BRITTON et al.) 10 March 2005<br>Whole document | |
| A | US 2006/0182357 A1 (LIU et al.) 17 August 2006<br>Whole document | |

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 05 October 2011 | 06/10/2011 |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200, WODEN ACT 2606, AUSTRALIA<br>E-mail address: pct@ipaustralia.gov.au<br>Facsimile No. +61 2 6283 7999 | Authorized officer<br>**RAJNI VERMA**<br>AUSTRALIAN PATENT OFFICE<br>(ISO 9001 Quality Certified Service)<br>Telephone No : +61 2 6283 2816 |

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.
**PCT/MY2011/000161**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX