

## **DESCRIPTION**

### **LPWAN BASED LAND SECURITY SYSTEM**

#### **TECHNICAL FIELD**

The present invention is related to a LPWAN based land security system that is used in any kind of open areas that any unauthorized passage (human-animal) is required to be identified and prevented from entering any kind of open areas that are under military protection (patrol zones, military crossing areas, etc.), in border areas, in factory areas, in special areas such as university campuses, in fields and fruit gardens, and that is capable of communicating in the required frequencies and that is comprised of hardware to detect motion.

#### **STATE OF THE ART**

The technical disadvantages encountered in the applications in the state of the art are as follows:

- MESH topology is used. Therefore, it is weak in terms of energy and security. Before the attack, enemy elements infiltrate the outposts of the station and approach the outposts of the station. In the borders, terrorists and smugglers make unauthorized transits by taking advantage of the mountainous terrain. Malicious people can steal and sabotage by infiltrating the factory environments. Also, damage to crops can occur by the entry of wild animals such as pigs in fields and fruit gardens.
- ACK message is not used. Therefore, the message transmission cannot be confirmed.
- Since there is no ACK, there is no mechanism to increase the interference durability by sending a stronger signal in case of ACK.
- It relies on expensive sensors like cameras or only PIR sensors that cannot differentiate.
- Mesh topology will not be able to transmit messages even if the end node is working and the intermediate nodes disappear. For this reason, it depends on the installation structure. For this reason, it cannot be

used in city conflicts. In city conflicts walls, barrier obstacles limiting horizontal observation, the number of UAVs and area focusing problems, as well as weather and weather conditions, can limit the possibility of observing from the air. In addition, when underground tunnels are opened and there is no possibility of observing them, an instant response is not possible.

- The combination of the synchronous mac layer and the sleep mechanism can cause messages to be delayed. Instant intelligence is limited. The messages are delayed to the center depending on various parameters. This process can take minutes.
- Since the signal range is short, it is possible to steal it if the sensors are moved and disconnected from the network.
- A software update cannot be done at all or is very difficult because it will cause too much load on the entire network.

## **DEFINITION OF THE INVENTION**

The present invention relates to a LPWAN based land security system developed to remove the above-mentioned disadvantages and bring new advantages to the related art.

The inventive LPWAN-based land security system is an intelligent stone security system that can detect and communicate with the necessary frequencies.

The advantages of the present invention are summarized as follows:

- Provides the ability to update the software when necessary.
- Real-time response.
- Provides more efficient battery use.
- A more durable model to interference (interference-jammer)
- ACK allows you to be sure that the message has been transmitted. If the ACK message is not received, it is a stronger mechanism against a possible jamming attack by sending a stronger signal.
- With a signal range of 10 - 40 km, the sensor can ask for help by sending a text message. Until security units find it, it is able to send its location for as long as it can. Due to the maximum range of 20 - 50 km, even if people try to

pick up and steal the sensor, it can ask for help by sending its location signal until security units' reach it.

- Due to the star of all the star topology, it can be used in city conflicts.
- The asynchronous mac layer provides instant intelligence.
- It does not require the use of expensive sensors such as cameras etc.
- Movements of enemies can be followed in urban conflicts by leaving them in urban areas, (due to the star of the all star topology, the system is active if only one is active).
- Software upgrades can be made later to the nodes that are left at various sites.
- Operators to connect to the system can take action without any intervention, (embedded bomb, Built-in Projector, Automatic moving UAV, audio device, Cameras).

## **DEFINITION OF FIGURES**

The following figures should be considered schematically in themselves with the reference numbers one by one.

Figure 1 The node unit is schematically shown in the inventive LPWAN based land security system.

Figure 2 The LPWAN-based land security system of the present invention is shown schematically around a police station.

Figure 3 The LPWAN-based land security system of the present invention is schematically illustrated in an internal location.

Figure 4 The LPWAN-based land security system of the present invention is illustrated schematically in a city conflict.

Figure 5 The network topology of the LPWAN based land security system is illustrated schematically.

## **REFERANCE NUMBER ACCORDING TO THE APPLICATION AREAS TO HELP DISLOSURE OF THE INVENTION**

### **A. Node Unit**

- A1. Sensors
- A2. External hardware interface
- A3. External hardware
- A4. Flash memory
- A5. RF communication unit
- A6. Motion sensor
- A7. Processor
- A8. Power supply or battery unit
- A9. GPS sensor
- B. Layout around the police station
  - B1. Sensor Line
  - B2. Safe Distance
  - B3. Station
- C. Inland settlement
  - C1. Linear layout
  - C2. Critical Internal Regions
  - C3. Station
  - C4. Important buildings
  - C5. Enemy Expected locations
- D. City Conflict
  - D1. Nodes
  - D2. Buildings
  - D3. Gardens
- E. Network Topology
  - E1. Node Sensor
  - E2. RF Communication
  - E3. Gateway-Base Station
  - E4. Local Traditional internet or intranet
  - E5. Local network
  - E6. Local server
  - E7. Central server

## **DISCLOSURE OF THE INVENTION**

The inventive LPWAN based land security system is a smart stone security system developed with a GPS sensor, a flash memory, a processor, a power supply and a motion sensor that can detect movement and can communicate with the selected frequencies required for the RF signal application.

The LPWAN based land security system of the invention provides a solution to the intelligent stone security system by the following methods;

- Due to the star of the all star topology, it can be used in city conflicts.
- The asynchronous mac layer provides instant intelligence.
- It does not require the use of expensive sensors such as cameras, etc.
- ACK allows you to be sure that the message has been transmitted.
- If the ACK message is not received, it is a stronger mechanism against a possible jamming attack by sending a stronger signal.
- Due to the maximum range of 20 - 50 km, even if people try to pick up and steal the sensor, it can ask for help by sending its location signal until security units' reach it.
- Movements of enemies can be followed in urban conflicts by leaving them in urban areas, (due to the star of the all star topology, the system is active if only one is active).
- Software upgrades can be made later to the nodes that are left at various sites.
- Operators to connect to the system can take action without any intervention, (embedded bomb, Built-in Projector, Automatic moving UAV, audio device, Cameras).

#### A. Node Unit

A1. Sensors: PIR, ultrasonic, etc. there may be various sensors.

A2. External hardware interface: Required external communication unit.

A3. External hardware: Optional external units that can be added.

A4. Flash memory: The flash memory on which the software and necessary records are stored.

A5. RF communication unit: It is the unit that can communicate between 0-infinite km, preferably a 5-50 km RF signal with the necessary frequencies for the application.

A6. Motion Sensor: A sensor, accelerometer and theft alarm will be used to detect when the node is moving.

A7. Processor: The unit that digitally processes the data of all incoming sensors.

A8 Power Supply: Power supply or battery.

A9.GPS Sensor: GPS receiver to be used to know the position of the nodes.

### B. Layout around the police station

B1. Sensor line: A sensor line is set up to be 30-100 meters in depth to detect the enemy elements passing through it.

B2. Safe distance: Providing advance notice by putting a distance in accordance with the military standards with the protected area.

B.3. Station: This could be another building to protect. It represents the area that needs to be protected.

### C. Inland settlement

C1. Border line layout: The sensor nodes are randomly dispersed at a distance of about 30 to 500 meters along the boundary lines, forming an electronic wall.

C2. Critical internal areas: In areas considered as important for passing or observing enemy elements, are inspected by sensors so that they do not perform malicious activities even in the case of infiltration with other methods (legal customs pass, or internal person's betrayal).

C3. Stations: A sensor system is installed at a distance to ensure the safety of the conflict area for the possible attacks to be prevented.

C4. Major Buildings: They are used around important and aggressive buildings such as industrial facilities, courthouses, etc.

C5. Places where enemies are anticipated: The areas that enemy elements can use, such as empty caves, warehouses and open spaces, are equipped with sensors only, without destroying the areas and a trap is established for these elements.

#### D. City Conflict

D1. Nodes: They are thrown from the air and delivered to the points in the city such as gardens between buildings.

D2. Buildings: It can be found as an obstacle to direct observation.

D3. Garden: It is a structure that can generate a warning before a possible attack and direct it to the UAV, in case of a movement inside them.

#### E. Network Topology

E1. Node Sensor: Detects people or animals nearby. Here, if an animal or human is said to produce a warning, it will produce or not produce a warning accordingly. In case of producing a warning, if the RFID module is added, it generates a warning with RFID by receiving the RFID of the nearby person, or in case the RFID is not received, with the information that it has not been received.

E2. RF Communication: Alerts are preset with ACK or without ACK. The warning can also be repeated using more power or changing the frequency if the ACK is not received. The number of repetitions is preset between 0 and infinity. The range of RF communication can range from 0 to infinite kilometers, preferably from 5 to 50 km, in open areas. The ISM may be communicated over a military or licensed band-interval, depending on the type of application being performed.

E3. Gateway-Base Station: This station can be found on a blimp or UAV on a land vehicle, or a fixed wing aircraft. It constantly listens on the selected frequency and feature. It communicates with the central server via traditional communication methods. It also sends the same messages here if it is requested to send a signal to the local secondary servers. (Important to keep the sensors active by sending a signal to the police server even if the general communication in one way or another is lost.)

E4. Local Traditional internet or intranet: This part will be used to provide communication between the central server and all gateways via traditional internet methods (GPRS, Cable, ADSL, Fiber, 4G), or an intranet solution depending on the application of the selected application.

E5. Local network: Establish a stronger local communication network so that sensors can function even when the central communication is interrupted by local communication at the time of an attack.

E6. Local server: This is a local backup server where local elements can use the existing sensor network if the enemy elements block the Local Traditional internet or intranet communication in the area under attack. (There is a gateway + server in the station, normally the center is used as long as the central communication is not interrupted, but the local server and gateway are used at the time of the siege). If the central server cannot be reached, it can perform all its functions at the local level.

E7. Central server: the messages to be received from all the gateways are resolved and warnings are generated, and the actions to be taken are determined here. Then the required action is again handed to the operator through the gateway (UAV auto-launch, automatic launch of the relevant projector, camera orientation, bomb detonation).

In this connection, Sensor fusion algorithms can be developed to make the received data more meaningful (human number, animal sex-number separation) and lower unit costs with cheaper sensors.

The inventive LPWAN based land security system has been modified to include different sensors;

- For measuring air quality in mines,
- Leakage control in piped areas such as water, oil, or sewage
- To prevent unauthorized transitions of i.e. refugees who come to the shores with acoustic sensors.
- Measuring moisture, soil quality in fields
- It can be mounted to control wild life in forest areas.



## CLAIMS

1. The inventive LPWAN-based land security system is characterized by being comprised of; Node unit (A) Sensors (A1), External hardware interface (A2), External hardware (A3), Flash memory (A4) for keeping the software and necessary records, RF communication unit providing communication in required frequencies for application by RF signal between 0-infinite km, preferably 5-50 km (A5), motion detector (A6), which can detect when the Node is moving, Processor (A7), which can digitally process the data of all incoming sensors, Power supply or battery unit (A8), GPS sensor (A9) which is used to know the location of the nodes.
2. The characteristic of the inventive LPWAN based land security system to be comprised of:
  - Due to the star of the all star topology, it can be used in city conflicts.
  - The asynchronous mac layer provides instant intelligence.
  - Does not require the use of expensive sensors such as cameras etc.
  - ACK allows you to be sure that the message has been transmitted.
  - If the ACK message is not received, it is a stronger mechanism against a possible jamming attack by sending a stronger signal.
  - Due to the maximum range of 20-50 km, even if people try to pick up and steal the sensor, it can ask for help by sending its location signal until security units' reach it.
  - Movements of enemies can be followed in urban conflicts by leaving them in urban areas, (due to the star of the all star topology, the system is active if only one is active).
  - Software upgrades can be made later to the nodes that are left at various sites.
  - The operators that will be connected to the system must be able to take action without any intervention.
3. The LPWAN based land security system according to claim 1, characterized in that it comprises: The area surrounding the outpost (B), the inland settlement (C), the city conflict (D), network topology (E).

4. It is the LPWAN based land security system according to any of the preceding claims characterized in that it comprises; Sensor Line (B1), which detects the enemy elements that will pass through as if the area surrounding the outpost (B) depth will be 30-100 meters. Secure Distance (B2), which provides advance notice by putting a distance in accordance with military standards in between the protected area. The Police Station (B3) represents the area to be protected.
5. It is the inventive LPWAN based land security system according to any of the preceding claims characterized in that it comprises; the inland settlement (C), the sensor nodes are randomly dispersed to a distance of about 30 to 500 meters along the boundary line, where the boundary line (C1), which is almost an electronic wall, is used to detect the presence of sensors that prevent them from engaging in malicious activities even in the case of infiltration by other means (illegal customs passage, or betrayal of the inside person) to the inner regions (C2) by inspecting them, and establishing a sensor system in the distance to ensure the confrontation security around the outposts (C3). Important buildings (C4) used around important and aggressive buildings, equipped with sensors without destroying areas where the enemy elements will be used, and providing a trap for the elements (C5) that are expected to arrive.
6. It is the inventive LPWAN based land security system according to any of the preceding claims characterized in such a structure that; City Conflict (D) Nodes (D1) reach the points where buildings cannot be directly observed in the city by being thrown out from the air, Buildings (D2) which are obstacles to direct observation while moving in the Garden (D3).
7. It is the LPWAN based land security system according to any of the preceding claims characterized in that; Node Sensor (E1): Detecting people or animals nearby and if the RFID module is added, in case of producing a warning, it also receives the RFID of the nearby person and generates a warning together with the information not taken when the RFID is not received together with the RFID; RF Communication (E2): In case of alerts with ACK or without ACK. The warning can also be repeated using more power or changing the frequency if ACK is not received. The number

of repetitions is preset between 0 and infinity. The range of the RF communication can range from 0 to infinite kilometers, preferably from 5 to 50 km, in open areas. The ISM may be communicated over a military or licensed band-interval; Gateway-Base Station (E3): that can be found on a blimp or UAV on a land vehicle, or in a fixed wing aircraft, constantly listening on the selected frequency and feature, communicates with the central server via traditional communication methods and also sending the same messages here if it is requested to send a signal to the station servers; Local Traditional internet or intranet (E4): to be used to provide communication between the central server and all gateways via traditional internet methods; Local network (E5): establishing a stronger local communication network (E4) so that sensors can function even when the central communication is interrupted by local communication at the time of an attack; Local server (E6): to be the local backup server where local elements can use the existing sensor network if the enemy elements block Local Traditional internet or intranet communication in the area under attack; Central server (E7): resolving the messages to be received from all the gateways and generating warnings and determining the actions, then handing the required action to the operator through the gateway.

8. It is the inventive LPWAN based land security system according to any of the preceding claims characterized in that; Sensor fusion algorithms can be developed to make the received data more meaningful and reduce the unit costs with cheaper sensors.

**ABSTRACT****LPWAN BASED LAND SECURITY SYSTEM**

The inventive LPWAN based land security system is a smart stone security system developed with GPS sensors, a flash memory, a processor, a power supply and motion sensor that can detect movement and that can communicate with the selected frequencies required for RF signal applications.

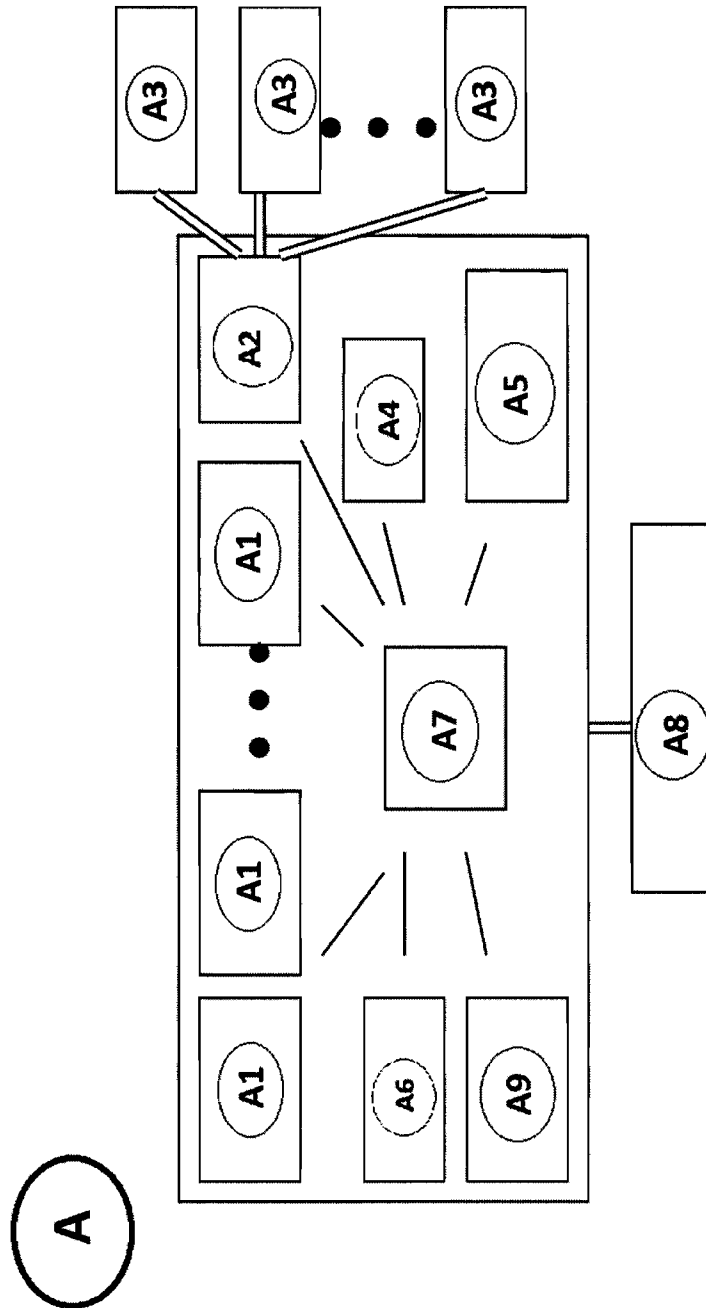


Figure 1

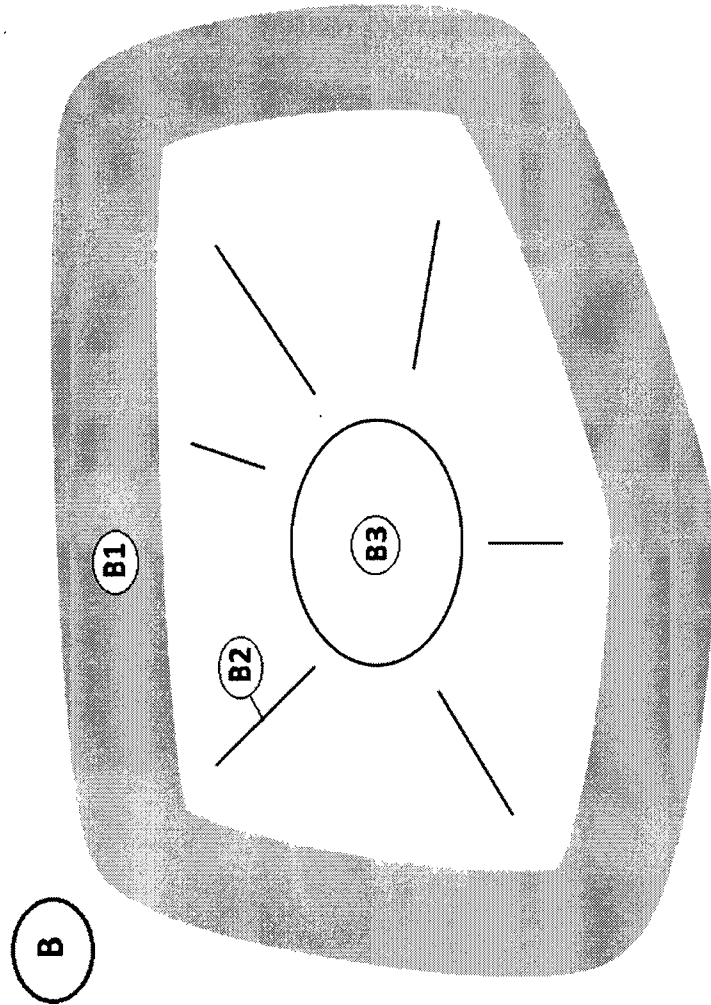


Figure 2

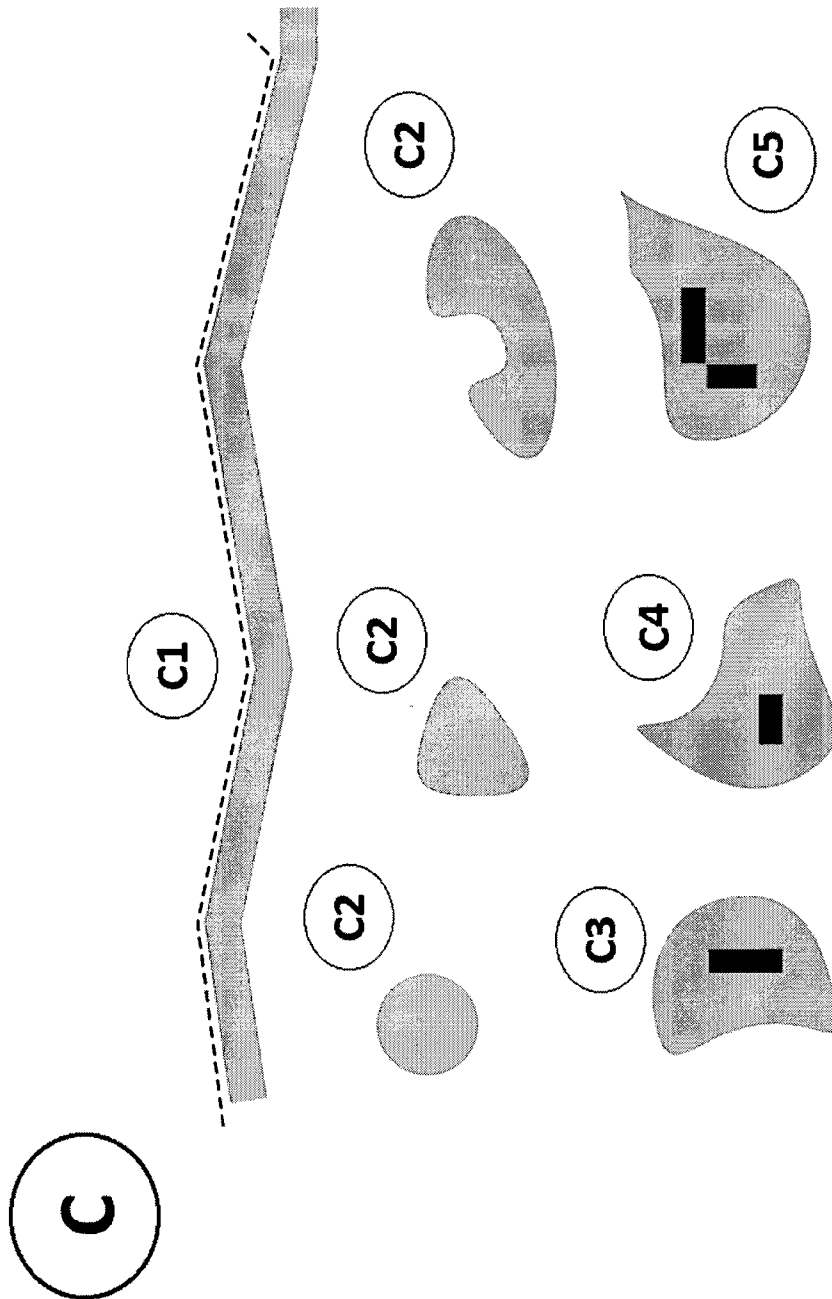


Figure 3

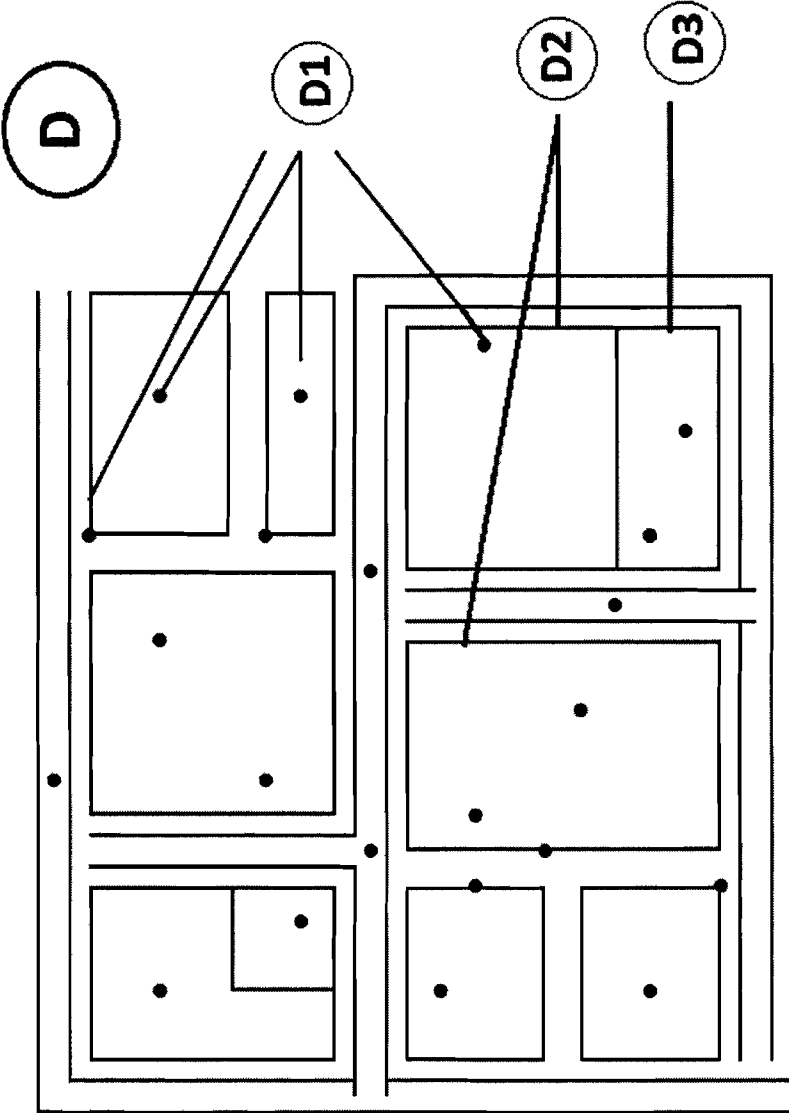


figure 4



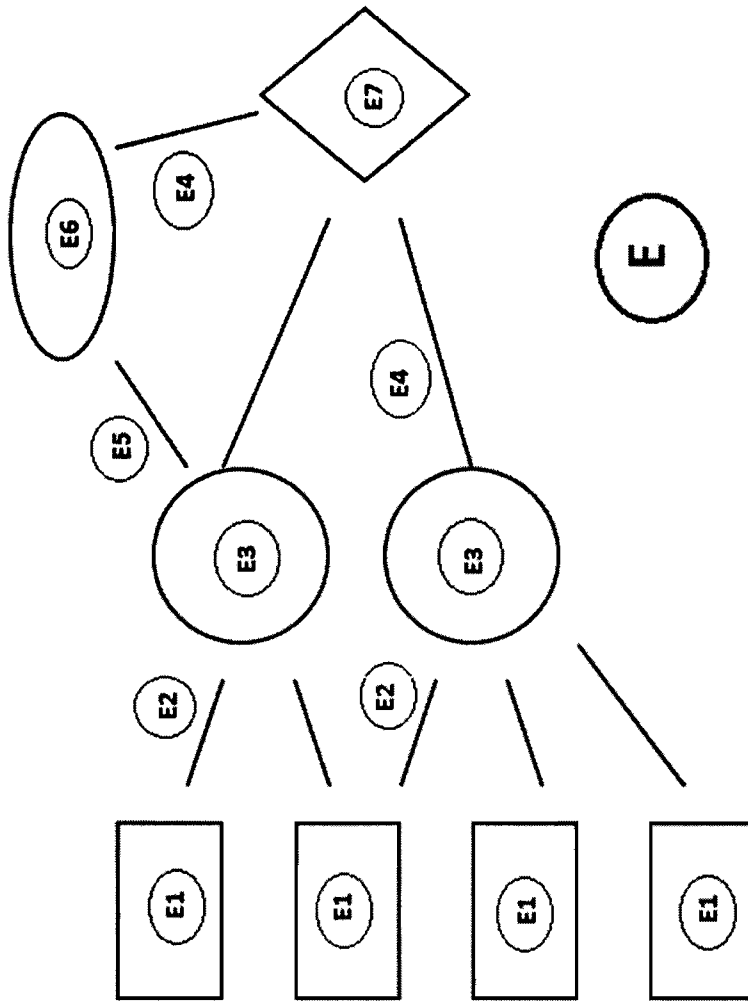


Figure 5