Research on Biochemical Rapid Detection of Army Battlefield

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Abstract. This paper mainly complete biochemical this network of Measurement and Control ammunition acquired node miniaturization, modularization and low cost design and integration, breakthrough the bullet medicine node scatters control, positioning, high impact resistance, this network of Measurement and Control ammunition node group acquired coordinated control, remote operation, the key techniques such as in order to further establish remote distributed fast biochemical information perception and supports the control theory of the basis network system.

Overview

Long-range rockets ammunition as carrier platform relative to other tools, such as unmanned aerial vehicle (uav), the traditional artillery has outstanding advantages, it has the overload of small, high precision, range far and fast firing rate characteristics, making it very suitable for chemical detection as the bullet drug delivery vehicles, and because of the characteristics of chemical detection is the diversity and complexity of the target. The diversity of the target lies in the variety of poisons and the simultaneous use of a variety of poisons, and the single sensor does not meet the requirements for information acquisition; The complexity is that the target usually has no specific location, most of which is distributed within a range, such as chemical gases. While identifying the target location, the target scope, direction, and density distribution need to be identified. Can use far air scatters setting fire to information network and reduce the overload resistance requirements of the bullet medicine chemical sensor, improve the localization accuracy of nodes, have remote detection function.

The Overall Technical

In the network of biochemical sensors, the bullet nodes are scattered randomly in the monitored area, which is accomplished by spreading out over a distant fire. Bullet medicine nodes of network in the form of self organization, real-time perception in the form of collaboration, collecting and processing the information in the network coverage area, and through multiple hops relaying mode will be monitoring data to the Sink medicine node of bullets, finally with the help of cruising in the relay communication drone recycling Sink above the monitoring area bullet medicine node data and sent to the remote center for centralized processing. On the other hand, the remote management center can control and manipulate the network's bullet nodes in real time.
Biochemical Monitoring Network Complex Submunitions Nodes

The Fixed Bullet Node

The design of the fixed bullet-drug node of the biochemical monitoring network should consider the following three principles.

Micro miniaturization. Miniaturization is the ultimate goal of sensor networks. Only the bullet point itself is small enough to ensure that it does not affect the target system environment; In addition to the specific use of battlefield reconnaissance, miniaturization is one of the first concerns.

Modular. Modularity is also a consideration in the design of sensor cartridges. Sensor bullet nodes should have complete, standardized external interfaces based on common processor and communication modules to accommodate different components.

Low cost. The high and low cost is an important indicator of how well the sensor network is designed. Sensor network bullet nodes are usually distributed in large quantities, and only a low cost can be used to ensure that the bullets are widely used. This requires that the design of each module of the wireless sensor's bullet nodes should not be particularly complex, or it is not conducive to reducing costs.

In addition, under the condition of lack of physical security guarantee to ensure the accurate and transmission of data security and the bullet medicine node circuit work under harsh conditions of stability, etc, is also should consider the problem.
Based on these principles, the hardware architecture of a generic bullet point for a wireless sensor network should be as simple and applicable as possible.

Microminiaturization of fixed wireless sensor bullet medicine node is composed of six modules: impact of spherical shell, suspension balloon, data acquisition module, the processor module, wireless communication module and power management module; The structure composition is shown in figure 2. Shock of the support part of spherical shell is of high strength lightweight aluminum alloy materials, outside the parcel layer damping rubber, the ball is composed of two hemispheres, one side is flat, at the bottom of the battery box and mote board and sensor board through the damping spring and hemisphere fixed connection, and filled in the epoxy resin to further achieve the goal of shock absorption and fixed, the biochemical sensor is sensitive to the end are exposed to the outside of the epoxy resin, mote plate on the wireless communication module of antenna by extension cord from the board, the balloon will be suspended in the air above the ground a certain height, in order to improve the communication distance. The outer shell of the other hemisphere processes holes to facilitate the monitoring of the environment by biochemical sensors, and the interior of the hemisphere is hollow. The structure of the ball no matter which kind of attitude to be born, due to the center of gravity in the side of the globe, it will end in stable flat side on the ground, antenna and even the whole sphere can by the balloon floating in the air, meet different monitoring requirements.

The Mobile Bullet Node

According to the requirements of a wide range of biochemical rapid perception information, with the method of much fire power projection, will explore the biochemical measurement and control network of mobile node and fixed shot medicine node within the target area for large area rapid deployment, the rear teleoperation and bullets medicine combination of node local autonomous behavior, moving the bullet medicine node groups on the basis of positioning, mutual collaboration network awareness and feedback information. For special deployment methods and unknown
complex operating environments, the mobile bullet nodes need to be small, modular, and low cost characteristics. Mobile bullet medicine biochemical measurement and control network node overall structure by mechanical transport module, control module, wireless communication module, sensor module, navigation module, power supply module, remote control terminal operation, etc.

**Throwing Control and Anti-high Overload Technology**

**Throwing Control Technology**

Selecting the fixed bullet point and the throwing control of the moving bullet point are followed by the following principles:

1. the control should be simple, lightweight, reliable in performance, good in safety, good in technology and easy to install.
2. throwing control should help the bullet point to reach the preset position wherever possible.
3. the impact overload caused by the control of the projints should not affect the normal operation of the fixed bullet and the moving bullet.

Using a parachute landing, fixed nodes and mobile shot fired at the node with a parachute, fly in the rocket or after the plane dropped to the target area, automatically raise payload, the parachute, for mobile medicine node of bullets, when close to the ground, setting off the ground height, through nearly a sense of control, automatic cut off the parachute rope, prevent the rope winding mobile bullet medicine node.

**Anti-high Overload Technology**

From the circuit board, the casing mechanical structure design, structure design with elastic buffer and potting technology four aspects to improve the environmental adaptation of the bullet medicine node and protective ability.

1. circuit board structure design
   Under the premise of not affecting the electrical characteristics of the circuit, follow the following principle: adopt modular design, each module adopts small size circuit board. The components are small and overloaded.

2. design of shell mechanical structure
   Because the circuit adopts modular design, the shell also adopts modular design to increase the mechanical strength of the whole system. Due to metal aluminum with a small specific gravity, light weight, easy processing characteristics, is used in many processing occasions metal aluminum, so we use hard alloy material processing bullet medicine node shell. According to the different installation requirements of biochemical sensors, considering the bullet drug resistance to overload characteristics of node, electromagnetic compatibility, resistance to radiation performance problems, reasonable mechanical structure design.

3. buffer technology
   Buffering is an effective way to improve the ability of the composite test system to withstand high overload. Because the bullet point is composed of non-metallic materials, it is less intense. If sensors, measuring circuit and the shell are directly related to the rigid connection, it is difficult to ensure the circuit under the effect of scatters and adding rate to fall to the ground overload and reliable work, buffer used two methods: USES the rubber spring buffer and using glass ball to buffer.

4. filling technology
   The bullet medicine node high overload resistance ability, the main method is to use potting on fixed bullet medicine node can be a wide range of potting, to move the bullet medicine node can be filled within a certain range. The filling and sealing of the assembled circuit is applied to the assembled circuit in a certain temperature condition, and the assembled circuit is solidified into a module. After such encapsulation, the system has greatly improved its anti-overload performance.
Target Tracking Technology for the Biosensor Network

The complexity of biochemical information is that there is no clear location for biological targets, most of which are distributed within a range, such as chemical gases, as shown in figure 3. While identifying the target location, the target range and density distribution need to be identified. So there are two things to consider about tracking such goals. Is location and move the bullet medicine node to completely cover or around the target area, 2 it is to detect the target's internal situation, including adaptively adjust the target coverage of node density, in order to better detect the target. When the target into a possible area, the area and the nearby nodes are activated, to move the region so that the target may be covered in the area, also need to make sure that the whole network connectivity, allow information to be back to the monitoring center. As the target moves, some nodes in the region move away from the target and re-enter the communication state. Other nodes are added to the new test. Throughout the configuration process, the minimum amount of energy consumed by all nodes moving and communicating with each other is guaranteed. This topic will study how to maintain the minimum energy dissipation method while effectively tracking the target. How to guarantee under the premise of small energy consumption, realize the network of independent network, optimization, and target tracking, for it is not easy to maintain the remote sensor network is an important research issue.

Figure 3. Simple (left) and complex (right) diffusion biochemical targets follow.

Concludes

To establish a remote biochemical reconnaissance system, rapid and accurate, to effectively reduce the enemy in the future local war destruction of biological weapons and lethality, save the army effectives, etc all have important practical significance. In order to adapt to the army under the new historical conditions, therefore, the demand of the combat mission and the combat mission, the development of integrated joint operations automatically monitoring biochemical attacks reconnaissance warning network system and equipment, improve the army's biochemical protective support capability.

The space of a whole mesh proposed biochemical detect bullet is for chemical protective equipment requirements, the present and future of the army to break through the army now im in remote, fast and complete the limitation of detecting and early warning, promote the establishment of the army new highly informationization, networking and automation remote rapid response im detection and warning system.

References