Study on the Design of Intelligent Positioning Clothing for Preventing the Elderly from Getting Lost

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Abstract: In response to the increasing trend of population aging and the frequent loss of the elderly in China, the modern intelligent positioning technology is applied to clothing. Based on the modern electronic technology, Laut Air 530 positioning module is installed in clothing by means of special process to develop a type of Intelligent positioning clothing for preventing the elderly from getting lost, which works with an App. According to the research results, this type of Intelligent positioning clothing for preventing the elderly from getting lost is able to trace location of the elderly quickly and prevent the elderly from getting lost effectively.

1. Research Background

In recent years, the trend of population aging in China has been increasingly significant. According to the 2018 census data, the number of people over age 60 had exceeded 240 million, accounting for 17.3% of the total population. The somatic functions of the elderly will gradually degrade with age, accompanied by frequent occurrence of cognitive obstacles, memory loss, and difficulty in walking. Therefore, clothing made for body protection of the elderly is especially important. Intelligent clothing attributing to the development and advancement of technology is becoming more and more popular, and a lot of products have sprung up in the field of protective clothing for the elderly, such as intelligent protective underwear to assist the elderly in walking, fall-protection & alarm clothing for the elderly and outdoor monitoring clothing for the elderly, etc. It indicates that the elderly have a great demand for Intelligent clothing.

According to the Status White Paper on the Lost of China’s Elderly issued by Zhongmin Social Assistance Institute and Toutiao in the Ministry of Civil Affairs on October 9, 2016, about 500,000 aged people got lost in China every year, and about 1,370 aged people got lost every day; regarding the age, the elderly over age 65 are easy to get lost, accounting for more than 80%. The design and development of Intelligent positioning clothing for preventing the elderly from getting lost will effectively alleviate this social problem.

2. Analysis of the Design of Intelligent Positioning Clothing for the Elderly

2.1 Design Philosophy of Intelligent Positioning Clothing for Preventing Getting Lost

Heavily depending on GPS and Beidou positioning technology, the design of Intelligent positioning clothing for preventing the elderly from getting lost integrates intelligent positioning chips with clothing, and achieves anti-lost positioning, which is a distinctive function, under the premise of ensuring that the clothing is comfortable, breathable, easy to put on and take off, and easy to wash and wear. When the elderly who go out or leave the place of residence cannot recognize the way, the family can locate the elderly by virtue of the app, and rescue the elderly in a timely manner to prevent
accidents.

2.2 Application Status of Positioning Technology in Clothing

2.2.1 Application Status of GPS Technology. GPS, a positioning technology featured by its advantages in wide positioning range and small error value, is used frequently and applied maturely in positioning function of objects such as vehicle, mobile phone and smart watch. It can meet requirements for positioning in various forms versatilely. The concealment of locating element mounting position, accuracy and stability of the finished product and positioning should be highlighted for applying GPS technology to clothing. In view of this characteristic, the position of the invisible pocket merits attention in the structural design of positioning clothing, and positioning chips with stable signal, high accuracy, and small size are preferable.

2.2.2 Forms of Application of Positioning Technology in Clothing. The currently common way to adopt positioning function to clothing is to interface with the positioning device while connecting with third-party devices and making the target clothing functional and intelligent. Taking smart watches with relatively mature application as an example, installing sensors and connecting to a wireless network give access to information such as the running route, running speed, kilometers and calorie consumption in a real-time manner.

Alternatively, GPS or other positioning devices are directly placed in the target clothing. The essential is designing external related devices based on clothing modeling, namely, combining small positioning element with the clothing style, and making positioning element invisible to ensure that the clothing is pleasing to the eyes.

3. Hardware and Software Design of Intelligent Positioning Clothing

3.1 Hardware Information
The Yinerda Laut Air530 chip is chosen as the positioning module, as it is suitable for intelligent clothing for its advantages of small size, low power consumption and strong signal. As the main control chip of SCM, the STM32F103RCT6 chip can analyze the data transmitted from the positioning module with high accuracy, efficiency, and stability by programming. Furthermore, its advantages of high efficiency and stability, ultra-low energy consumption and abundant interfaces are desirable for product development and design.

3.2 Software Program Design
The positioning module Air530 chip processes information such as the current position, speed based on broadcast ephemeris of positioning satellites, and then transmits real-time positional information by connecting its built-in GPRS with the server. The guardian can activate the background of the mobile App to receive information and give instructions. The specific working principle is shown in Figure 1.
4. **Style Design of Intelligent Positioning Clothing for the Elderly**

4.1 *Style Design*

The pattern of clothing should be designed according to the physical needs of the elderly. In view of the physical features of most elderly such as slow movement and hand anchylosis with decreased flexibility due to the age, in the style design, the clothing should be loose, comfortable, and easy to put on and take off, with cumbersome and unnecessary decorative parts removed as much as possible. Under the premise of ensuring the above basic conditions, the style should also be aesthetic for the elderly and the overall design should be decent and graceful. Therefore, the sleeveless waistcoat is chosen as the basic style of the positioning clothing. The style is shown in Figure 2.

![Software Flow Chart](image_url)
4.2 Fabric
The fabrics should ensure that the positioning element can normally dissipate heat and send/receive signals and the clothing is comfortable and nice. Fabrics with poor air permeability or interference with signal such as leather, tpu, coated composite fabric and metal-containing fiber are undesirable. Pure-cotton fabric with the advantages of good air permeability and skin-friendliness is preferable for the design.

4.3 Combination of Style and Positioning element
The position of the electronic components on the clothing should be reasonably designed to ensure good concealment without affecting the comfort and flexibility of physical movement. What's more, in order to avoid excessive consumption, the connecting wires between the positioning components should be kept from being bent for multiple times. For the sake of signal stability of the positioning element, the element should be located far away from communication devices, avoiding joints which move frequently and the pocket where electronic devices may be put in. As far as this consideration as concerned, the positioning element should be placed on the shoulder. Taking the convenience of taking out the element to wash the clothing into account, the inner lining of the clothing is equipped with a hidden pocket for the element; for the sake of convenience of battery replacement, the lithium battery is placed in the out pocket. The placement of the element is shown in Figure 3.

5. Conclusion
The rationality of the technology and hardware integrated design of the Intelligent positioning clothing for preventing the elderly from getting lost studied in this paper still needs to be improved. To be
specific, the comfort and aesthetics of the clothing are subject to the influence of the integration of the positioning element and the clothing, radiation to the contacted body, and the finishing and maintenance of the clothing. In the following improvement, the object of design service will remain the starting point for design, the object’s special needs for clothing will the identified better to solve the difficulties and remove hidden dangers for further optimization of design. In the future of the clothing industry, the intelligent clothing design system will go for perfect and play a key role.

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