Design of a Walking Stick for the Aged

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1.

Abstract-Aiming at the loss of the elderly caused by the increasing aging of China and the current problems in the development of smart crutches, a threaded adjustable smart crutches composed of lighting lamps, reflective modules and positioning devices are designed. The crutches are mechanically designed using the parameters of the elderly's height and weight. At the same time, an intelligent positioning and communication system based on Beidou navigation is designed to record the travel status and location of the elderly in real time, which can meet the daily travel needs of the elderly.

Key Words-Helping old machinery, GSM communication, Assisted walking.

I. INTRODUCTION

At present, China's population is aging [1~3]. With the aging rate increasing year by year, the incidence of lost and lost events of the elderly is rising, which seriously affects the normal travel of the elderly [4]. It is urgent to design a device to prevent the elderly from getting lost and lost, so as to assist the elderly to travel normally. As the elderly often use crutches to assist travel, it is of great significance to add an intelligent crutches to prevent the elderly from getting lost without increasing the burden of the elderly.

The existing crutches mainly include traditional integrated crutches, crutches and intelligent crutches. The structure of the integrated crutch is stable and reliable, but its disadvantage is that it can't adjust the length of the crutch to adapt to different users; the crutch is mainly composed of crutches and seats, which has strong adaptability to users and is convenient for the elderly to sit and rest. However, the addition of seats increases the weight of crutches and reduces the overall portability. The existing intelligent crutches are mainly attached with GPS and GSM devices [5,6] on the crutches, which can realize the real-time positioning of the elderly, reduce the risk of getting lost and lost, and the high cost is an important factor restricting its promotion. In addition, the existing crutches and intelligent crutches adjust their own length by the way of pin expansion, which has poor reliability. Therefore, it is urgent to design an intelligent crutch with stable structure, strong reliability and positioning function. Based on the previous research, this paper designs a thread adjusting intelligent crutch based on Beidou navigation. The crutch has the characteristics of light structure, reliability and high degree of intelligence, in order to contribute to the development of China's elderly machinery.

II. MACHINE STRUCTURE AND WORKING PRINCIPLE

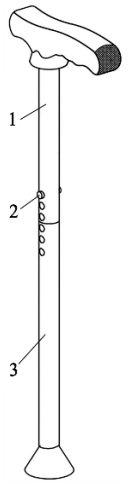
2.1Machine structure

The intelligent crutch is mainly composed of upper crutch device, lower crutch device and positioning pin, as shown in Figure 1. The crutch is made of carbon fiber material and weighs 0.62 kg. Its length can be adjusted from 75~ 105 cm [7-8] to meet the needs of elderly users with different heights.

2.2. Working principle

Before use, the length of the crutch is adjusted through the thread to adapt to the height of the user and the comfort degree of the crutch when assisting, and then the thread is locked through the pin.

When the intelligent crutch is used in the dark environment, the light in the front of the handle can be turned on, and the reflective device behind the handle can reflect the light from the rear, so as to attract the attention of the rear vehicle drivers or other operators to the crutch users, and improve the safety of the elderly users in the dark environment. Through the gyroscope and Beidou positioning module, the status and position of crutches can be determined in real time. In the working state, when the gyroscope detects that the crutch has an angle change of more than 70 ° and does not reset after more than 25 s, it is judged that the elderly fall (most of the elderly can stand up again within 18 s after falling), and the alarm information is sent to the mobile phones of relatives and friends through the GSM module. At a later time, if the gyroscope is reset and the swing angle is in accordance with the normal walking mode, it is judged that the old man has recovered, and the information is sent to the monitoring mobile phone of relatives and friends again to report his safety. The crutch provides security for the elderly users through the comprehensive function of each module.

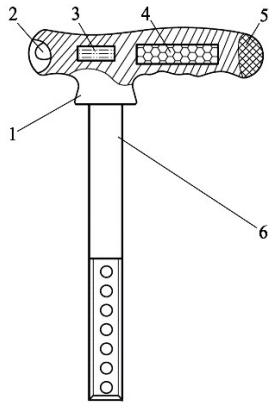


1. upper crutch device 2. positioning pin 3.lower crutch device

Fig 1 Screw adjusting intelligent walking stick for the aged

III.Design of key components

3.1Design ofupper crutch device

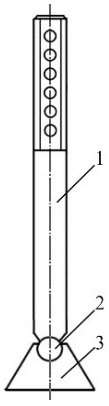


1.Handle2.Lighting3.GSM communication module, gyroscope, Beidou positioning module
4.DC power supply module5.Reflective module6.upper crutch body

Fig 2 upper crutch device

The upper crutch device is mainly composed of a handle and an upper crutch. According to ergonomics, the shape of the handle is designed to be comfortable to hold, as shown in Figure 2. The intelligent system that monitors the crutches status is located inside the handle. The intelligent system mainly includes lighting, GSM communication module, gyroscope, Beidou positioning module, DC power supply module, and Reflective module. Among them, LED lighting and reflective modules can assist the elderly to walk in a dark environment; the gyroscope can determine the state of crutches, thereby determining the walking dynamics of elderly users, the Beidou navigation module can determine the user's position in real time; the GSM communication module can achieve fixed points The function of transmitting the walking status and real-time position of the elderly to the mobile phones of relatives and friends to ensure the safety of users.

3.2Design oflower crutch device



1. Upper crutch body, 2. Positioning ball3.Support

Fig 3 Lower part of walking stick

The lower crutch device plays a supporting role and is mainly composed of the lower crutch body, positioning ball and support, as shown in Figure 3. It is fixed between the lower crutches and connected with the support ball pair. When working, it can ensure that the support is always in full contact with the ground and enhance the stability of the crutch.

The upper and lower crutches of the crutch are connected by threads, and the length of the crutch can be adjusted. Compared with the traditional one-piece crutch, the length of the crutch is adjustable and has strong adaptability. Compared with the existing intelligent crutches, the method of adjusting the length of crutches by screw thread has higher stability and longer service life.

3.3Design of intelligent security system

The crutch intelligent security system is mainly composed of Beidou positioning module, control unit, GSM module and other auxiliary units, as shown in Figure 4. The navigation module mainly relies on the Beidou satellite navigation system (Beidou navigation for short) for positioning. Beidou navigation is mainly composed of three parts: air surface section, ground section and user section. It can provide users with high-precision and reliable positioning, navigation and other services around the world, and can realize short message communication. The positioning accuracy can reach 10 m [9], meeting the requirements of intelligent crutches for the elderly.

The Beidou navigation module adopted by this crutch is UM220-III L dual-mode positioning module. The module can support Beidou navigation satellite receiver chip and gyroscope at the same time; through adaptive integrated navigation algorithm, it can accurately locate the location of the elderly. In areas with poor satellite signals, pure inertial navigation technology can continue to provide

high-precision positioning and attitude measurement for a long time. The communication GSM module selects SIM900 from SIMCOM.

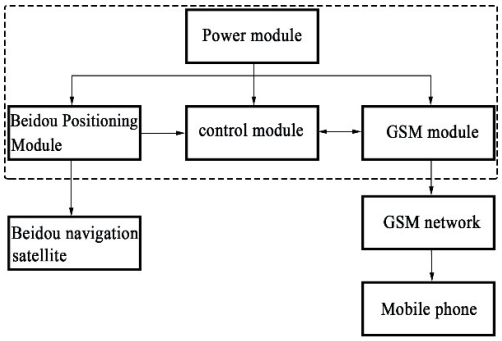


Fig 4Safety system framework of the intelligent walking stick for the aged

III. CONCLUSION

In this paper, according to the problems in the development of intelligent crutches and the loss of the elderly caused by the aging in China, a kind of intelligent crutches with thread adjustment is designed, which is composed of lighting lamp, reflective module and positioning device. The walking stick has the characteristics of convenient adjustment, stable structure and long service life. Before use, the length of the crutch is adjusted to a comfortable position by the thread, and then the thread is locked by the positioning pin. Compared with the existing way of adjusting the length of crutches by the expansion of pins [10-12], this adjustment method has the characteristics of higher stability and can prolong the life of crutches. At the same time, the intelligent positioning and communication system based on Beidou navigation is designed, which is convenient for relatives and friends to grasp the location and status of the elderly in time, and provides security for the elderly to travel safely. In order to make a positive contribution to the development of China's aging machinery.

IV. ACKNOWLEDGMENT

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