Application of Beidou Satellite Navigation System in Finding Separated Children

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Abstract. The Beidou satellite navigation system is currently one of the most advanced navigation systems on an international scale. The purpose of this work is to design a system framework based on the Beidou navigation system for the positioning and tracking of children. The novel system designed in this work includes a Beidou satellite system, a tracker assembly mounted on the sole of a child's shoe, a guardian's cell phone terminal and a monitoring computer terminal. In particular, the present work creates a new tracker assembly that is communicatively connected to the guardian's mobile phone terminal and the monitoring computer terminal through the Beidou satellite system, respectively. This paper designs and implements an effective monitoring and tracking of children's location based on Beidou navigation, which is worth promoting and applying.

Keywords: Beidou Satellite Navigation System, positioning tracking, wireless transmission, pressure generation.

1. Introduction

Nowadays, the application of Beidou satellite systems in various industries has become a hot topic, and how to cross-utilize them in multiple fields in various industries has just become a hot topic nowadays. In this context, the Beidou navigation system can support many civil technologies. For example, the Beidou satellite system can provide personal location services and thus cooperate with navigation software, so that you can easily find the route you want to take by using a cell phone or car satellite navigation device equipped with a Beidou satellite navigation receiver chip. Secondly, in the field of meteorology, the Beidou satellite system can provide real-time feedback on cloud cover information to the meteorological department, so as to get accurate weather information of various places and improve the ability of our country's meteorological disaster prevention and mitigation. Meanwhile, the safety of children is receiving attention from all walks of life, and people are eager to make use of future technologies to ensure the safety of children to the greatest extent. At present, literature review and research found that many studies focus on children's positioning and tracking, including: relying on GPS positioning system of children's positioning watches[1]; locator in the water bottle to make children's positioning kettle[2]; locator in children's clothing to make a locatable children's clothing[3]; add a camera to the original GPS positioning watch to obtain real-time image information of children[4], etc., all these locators are invariably used to locate children. Without exception, these locators are all using
GPS positioning system. However, little research has been reported on the application of Beidou navigation to children's positioning. Therefore, there is an urgent need to develop a new child location tracking system based on Beidou navigation to overcome the shortcomings in current practical applications.

2. General Framework of the Novel System
As shown in Fig.1, the new child location tracking system designed in this work includes a Beidou satellite system, a tracker component installed in the sole of a child's shoe, a guardian's cell phone terminal and a monitoring computer terminal.

1) Among them, the tracker component designed in this work is communicated and connected to the guardian's mobile phone terminal and the monitoring computer terminal through the Beidou satellite system, respectively.
2) Secondly, the Beidou satellite system is used to track the position of the component in real time.
3) Moreover, the tracker component is also used to send alarm signals to the monitoring computer via the Beidou satellite system.
4) In addition, the guardian's cell phone and the monitoring computer are used to obtain the real-time position information of the tracker component and send alert messages to the tracker component via the Beidou satellite system.

![Figure 1. General framework of the novel system involved in this paper](image)

3. Development and Design of Special Tracker Components
As shown in Figure 2, a new type of tracker assembly is designed in this paper. It features a tracker assembly that utilizes pressure generation and installs this device in the sole of the shoe, increasing concealment and effectively enhancing the ability to respond to emergencies. The pressure generation uses the vibration generated by the sole of the shoe when the child walks and runs to generate electricity and power the entire system. The tracker assembly includes a heart rate sensor, an audio module, a master control chip, a wireless transmission module, a remote control switch, a GPS module and a pressure generation module installed in the sole of the child's shoe. The audio module and the wireless transmission module are mounted on the front part of the sole. The heart rate sensor, master control chip, remote control switch and GPS module are installed in the middle of the sole, and the heart rate sensor...
is set close to the bottom of the child's foot to facilitate the collection of heart rate. Pressure generation module

As shown in Figure 3, the main control chip is a microcontroller, and the heart rate sensor, audio module, wireless transmission module, remote control switch, GPS module and pressure generation module are electrically connected to the main control chip. In the application, the GPS module is used for positioning, and the GPS location of the police station and station in the place of residence is set inside the main control chip, and the remote control switch is issued by the guardian to control the opening and closing, and the whole device is assembled in the sole of the shoe, and a variety of shoes of different sizes and styles are matched in turn, and the shoes also need to be customized, only the sole is left with assembly space, and the device can be disassembled and installed as the child develops multiple disassembly and installation, improving the utilization rate.

In addition, to increase structural strength, the entire tracker assembly is made of softer plates, and the main control chip is chosen to be smaller to be as miniaturized as possible to reduce the impact of vibration and pressure on the reliability of the system, and the heart rate sensor is placed close to the foot to facilitate the collection of heart rate.
4. The Overall Operation Strategy of the System
In the actual operation of this system, the specific operation mode is shown in Figure 4, where there are three other strategies for different situations.

4.1. Strategy 1: The Child's Teaching Hours in School Mode
Firstly, the first one is the child's teaching time at school mode: the teacher in charge of the school will activate this mode, and the teacher in charge of the school will receive the child's "location information + heart rate information", and the real-time heart rate information is mainly for monitoring the child's physical health during school. When the child's location information appears outside the school during the teaching time, the built-in microcontroller system will combine with the GPS module to determine the child's location and send the heart rate information together with the location information to the parents and the teacher in charge of the school in real time, which can be used to monitor the child's behavior. If both the school and the parents think that the child is behaving abnormally, the system will send the location and contact number of the nearest police station to the parents, and send the child's "location information + heart rate information" together; at this time, the parents will have the right to turn on the audio module installed on the sole of the child's shoe through a remote switch, so as to make a judgment on the child's specific actions. At this time, parents will have the right to turn on the audio module on the bottom of the child's shoes through the remote control switch, so as to make a judgment on the child's specific actions, which not only ensures the child's privacy but also effectively protects the child's safety.

Figure 4. Three operating strategies for this new system
4.2. Strategy 2: Child Home from School Mode
The second is the child home from school mode: the teacher will enable this mode. For the school, the location information is used for the safety of the child on the way to school and on the way home, especially for the child's location on the way home from school. If a child is significantly off the road and does not return to the pre-determined "home address" within a certain period of time, the teacher will contact the child's parents in the first instance and determine if the parents know the child's location. If both the child and the parents think the child is lost, the system will send the location and contact number of the nearest police station to the parents, and send the child's "location information + heart rate information" together. At this time, the parents will have the authority to turn on the audio module installed on the bottom of the child's shoes through a remote switch to ensure the child's safety.

4.3. Strategy 3: Child's Vacation Out Mode
The third is for the child holiday out mode: enabled by parents, for parents, can receive the child "location information + heart rate information". Parents can actively check their child's current location, and also check their child's heart rate information at any time. Parents can check in real time, and when the child is lost, the system will send the location and contact number of the nearest police station to the parents. And the child's "location information + heart rate information" will be sent together. At the same time, parents will have the right to turn on the audio module installed on the bottom of the child's shoes through a remote switch.

5. Conclusion
In summary, a new child location tracking system based on Beidou navigation is designed to achieve the location tracking of children using the coupling of microcontroller technology, GPS positioning, audio module and heart rate sensor. At the same time, this new system can send the child's location to the guardian along with the nearest station alarm number and the nearest police station number, which can shorten the rescue time. The design proposes three tracking strategies, which can precisely adapt to the child's effective tracking in different modes and guarantee its safety to the greatest extent possible, and has high application value.

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