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Design of a New Page-Turning Laser Pen/Mouse of Multifunctional Wireless Based on Intelligence Conception

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Abstract

This research aims to focus on the disadvantages of single and complicated laser pointers. Based on the intelligent conception, a design program for a multi-functional new wireless mouse page-turning laser pointer is proposed. Compared with the laser pointer on the market, the advantages of this design program are to add wireless mouse and remote control function, which can help users do presentation activity in various occasions, and improve the operation efficiency, including the integration multi-function of mouse, keyboard, page-turning, laser guiding, and five integration functions of USB. While the product is compact, the keys are simple and the operation method is simple, reasonable application of page turning laser pointer and user organic combination, more exquisite and flexible collocation of multimedia application equipment, play a better intelligent application effect.

KEYWORDS: *Intelligent conception, Page-turning laser pen, Wireless mouse, Multi-function, Product design*

1. Introduction

According to the research report of the data network in china, the current network coverage of colleges and universities has reached 100 %, and nearly half of the provinces and cities have built local education networks to varying degrees, 50 % of primary schools, 65 % of junior high schools, and 90 % of senior high schools have established campus networks, showing that multimedia teaching has been popularized in the teaching situation of all schools (Yu, 2013). However, with the normal use of educational informationization and the new trend of deep integration with teaching, there are more requirements and dependence on multimedia teaching. In multimedia teaching, nowadays, teachers often need to carry more equipment and must control the computer through multiple mouse and keyboards, which affects the fluency and practicability of teachers' control. Generally, users must stand on the console before they can operate effectively, unable to leave the multimedia console, which hinders the use of teachers and unable to concentrate on the teaching situation (Chen, 2007; Luo, 2011).

It is reported that the general primary and secondary school teachers use multimedia platform teaching, most need to buy the corresponding laser pointer and other equipment, however, the source of laser pointer is different which may not fit to the public equipment. Although universities provide laser pointer equipment to assist teachers in teaching, the general laser pointer is limited for the function of turning pages and transmitting the laser light. If you need to further control the computer, you need to go back to the multimedia console to operate the mouse (Wang, 2007).

In addition, the existing laser pens on the market mostly use infrared light of left and right indicator light. In the brighter classroom, the infrared light's instruction effect is poor, which is unable to achieve the effect of guidance but also reduces the effect of teaching. Some functions more diverse page laser pen, have digital laser, vibrator remind, spotlight, magnifying glass, and special marks, but these complex key function, relatively easy to cause such page laser pen operation inconvenience problem. Even more, some products, when use laser operation and mouse operation, also need to switch motion, causing great inconvenience to the teaching process.

Based on this, this study proposes a set of ideas to design a new multi-purpose wireless mouse page-turning laser pen based on intelligent conception, which is aimed at various user groups, in an attempt to improve the efficiency of presenters demonstrating on multimedia platforms and large, medium and small conference rooms.

2. An Overview of Intelligence

Intelligence means that with the support of computers, networks, big data, Internet of Things (IOT), and artificial intelligence (AI), things can meet various human needs (Zeng,

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2021). It means that through the application of intelligent technology, it can gradually have human perception ability, memory and thinking ability, learning ability, adaptive ability, and behavioral decision-making ability. In various scenarios, it takes human needs as the center, actively perceive external things, according to the way similar to human thinking mode and given knowledge and rules, make decisions on random external environment through data processing and feedback (Wang, 2017; Mertala et al., 2022). Most of the above situations point to the development of robots. With the evolution of the times, the current intelligent development of artificial intelligence, automated factories, and automated driving is in a rapid development (Deng, 2019; De Silva & Alahakoon, 2022). No matter what the present and future will deeply influence human beings.

The application of intelligent technology is mostly reflected in the comprehensive application of computer technology, precision sensing technology, and positioning technology. The intelligent advantage of this kind of product are widely used in practical operation and application, which is mainly manifested in greatly improving the demonstration environment of the demonstrator, reducing the working intensity of walking back and forth, improving the demonstration quality and efficiency, improving the reliability of the demonstration equipment, reducing the maintenance cost, and realizing the intelligence of fault diagnosis. Intelligence is one of the trends in the development of human technology nowadays. In order to realize intelligence, the conditions of intelligent materials and design ideas as well as the operation of software are indispensable and important links.

Now there are some smart mouse with different functions and uses in the market, which can be wirelessly linked to any desktop, laptop, projector as well as game system by Bluetooth function. Meanwhile, provide 2D and 3D modes, instead of the traditional mouse on the desktop, you can also use the mouse in the air.

Smart mouse can remotely control the computer through Wi-Fi or Bluetooth, all the configuration of the function into one, instead of laser remote control pen for PPT demonstration (Zhang, 2011; Li, 2016), instead of data line, realize the two-way file transmission between mobile phone and computer, also can view the computer recently opened the file and so on function. A very good feature of the smart mouse is the gesture support function. Such as open a PPT file, click the phone mouse icon at the bottom of the screen, then click the upper right gesture button (four arrows), can realize the function of the laser remote control pen, click start/end slide, slide right next, left on a, slide up back to the first, slide down to the last one. When browsing the page, single finger up and down simulates the mouse scroll function, single finger left and right analog browser forward and backward, two fingers pinch zoom in and out the page.

Intelligence refers to a lot of functions, such as use each keys instead of keyboard; replacing the mouse to realize the interface "slide" function; use Universal Serial Bus (USB) interface to replace the data line to realize file transfer between laser pointer and computer; uses Radio Frequency (RF) technology to transmit remote control signals. Relative to infrared technology, RF technology can be 360 degrees of transmission and diffraction, without directionality. There is also no need to align between the transmitter and the receiver, as long as the receiver is not surrounded or covered by metal, intelligent remote control, and intelligent wireless. Moreover, there are similar gestures for picture browsing and audio and video playback. In general, the intelligent significance of mouse equipment is to integrate many functions into the device to achieve efficient operation purposes (Wang, 2007; Yuan, 2016).

In our design scheme, laser technology plays an important role. In the wave of intelligent manufacturing, laser technology, as an advanced technology form, laser technology can be perfectly integrated into the intelligent manufacturing scheme, and the intelligent production form will be more intelligent because of the increasing maturity of laser technology (Lu, 2009). The basic principle of laser ensures that it has monochromatic property, strong directionality and coherence, and high energy concentration. In similar indications, the requirement for energy concentration is relatively low, so the commonly used laser pointer emitting devices can be applied. The laser emitted by the laser pen is a solid laser, and its solid laser is a laser diode. In order to generate the laser, it is necessary to realize the particle number reversal, meet the threshold condition and the resonance condition. The laser emission module structure is shown in Figure 1.

The laser emission module includes the laser diode unit (composed of mounting base, diode, and current controller), signal generator unit, and optical lens. In the laser diode unit, the mounting seat is connected to the diode, the current controller emits a constant current, and the current enters the mounting seat to drive the diode to emit the uninterrupted laser. The signal generator is connected to the mounting seat, and the modulation signal enters the mounting seat to drive the diode, thus generating the modulated laser through the optical lens.

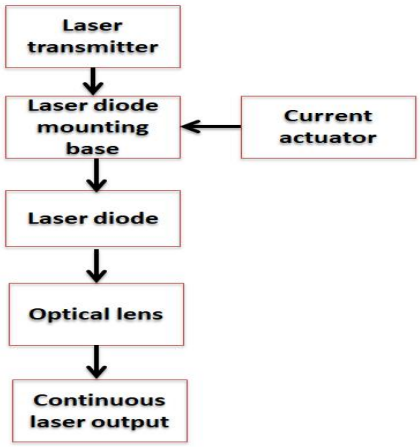

Figure 1 Design chart of laser emission module

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3. Design of Conception

Design ideas

The overall design scheme of this study is based on the intelligent design conception of integration and multi-function operation, which is mainly composed of four parts, such as intelligent system, execution system, control system, and application system. The conceptual scheme diagram is shown in Figure 2

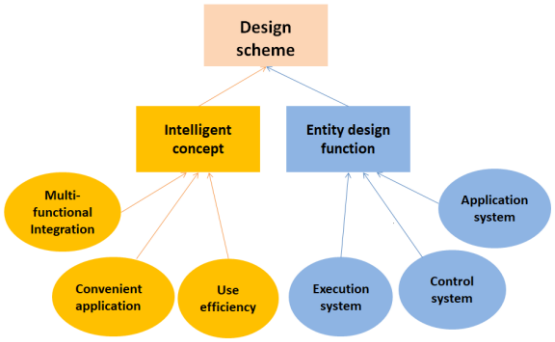

Figure 2 The design scheme of the intelligent a laser pen

The execution system is divided into three components: USB receiver, printed circuit board (PCB), and RF remote control. In the USB receiver section, the A7105 chip and Serial Peripheral Interface (SPI) device are used, which can provide the basic condition for success in product development. In the PCB part, using double board layer structure and use automatic and manual wiring combined PCB. In addition, RF remote control components will be used to directly control the computer in a wireless technology to achieve free page turning and random presentation of electronic documents (Liu et al., 2003). In which mainly adopts 2.4GHz ISM (Industry Science Medicine) wireless applications and SAW (Surface Acoustic Wave) to maximize the power saving of the product (show as Figure 4).

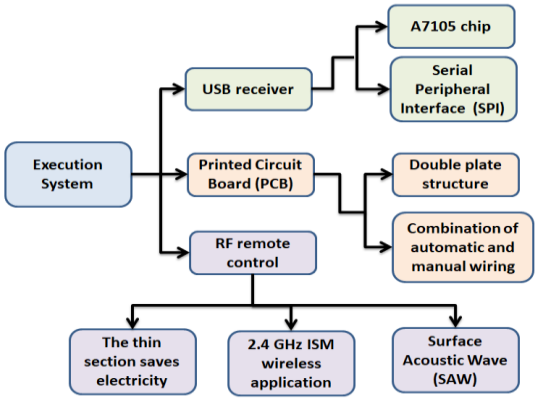

Figure 4 Design diagram of the execution system

The control system is divided into a central control unit and USB interface. The USB interface adopts the prominent flange structure and LP405 charging chip, focusing on realizing the product compatible with multi-system, multi-format files. The USB connector is designed as a combination of Type-C and USB, to make the equipment compatible with old and new specifications at the same time. In addition, the LP405 chip can be used to realize integrated intelligent charging (show as Figure 5).

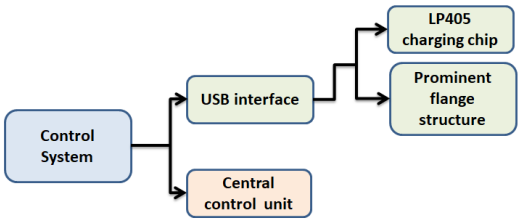

Figure 5 Design diagram of the control system

Application system part, distinguish the mouse control mode, keyboard control mode, and PPT play mode. The biggest feature of this design is to realize the mouse, keyboard, page-turning, laser, USB five-part integration function. The combination of the keyboard and mouse is the core of this design. Mouse control mode, including mouse-type multifunctional roller wheel and keyboard shortcut, left and right keys to achieve laser emission as well as front and back page turning effect. In the keyboard control mode and PPT play mode, the central screen cut round key, left and right selection key, and volume adjustment key are designed to realize remote volume adjustment and window switching and realize the multi-function application with the simplest button design (show as Figure 6). In addition, the overall composition scheme is shown in Figure 7:

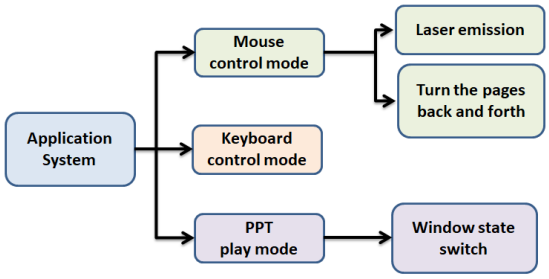

Figure 6 Design combination diagram of the application system

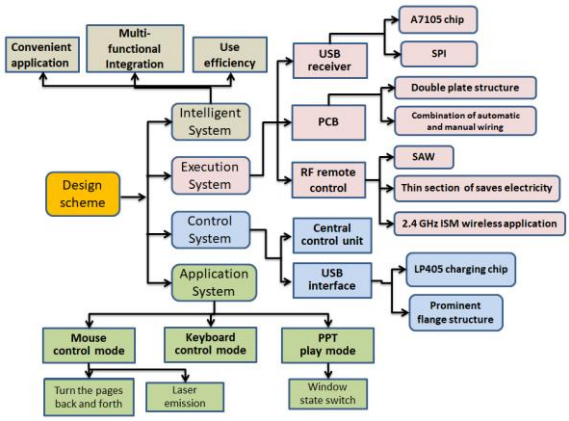

Figure 7 Composition scheme diagram of the laser pen

The operation process of the product

The operation process of the product is mainly the multi-function wireless mouse page turning laser pen sends the laser irradiation receiver, the receiver completes the conversion and

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sends the trigger information to the Interface Control Information (ICI) through the circuit, then the ICI communicates with the PC (Personal Computer), and sends the control information to the PC (Ishii et al., 2009), show as Figure8.

Figure 8. The operation process of the laser pen

4. Entity of Design Scheme

A systematic review

This study's design product is a multi-functional new wireless mouse page-turning laser pen, mainly including each button, roller, upper and lower shell, middle plate, laser lamp, switch, charging port, USB and storage port. Its highlight is the combination of the wheel and the left and right keys in the mouse, and the special hollow wheel setting can achieve the front and back page turning and laser emission these three functions, but also clever contact on the keyboard single button and combination button convenient function, namely left and right move key, window switch button, and volume adjustment button. The laser pen is equipped with a wireless mouse and keyboard functions. The keys include the center cut screen round key, the left and right selection button, and the volume adjustment button. The first two can realize screen switching, while the latter can realize volume adjustment, which is convenient for users to switch the window and adjust the volume remotely. While realizing the diversification of product functions, the product can also meet the requirements of small products, simple keys, and simple operation methods (Han, 2015).

The design of mouse-type multi-function wheel and left and right keys has the multi-function wheel replacing the original three key functions to realize the front and back page turning and laser emission, aiming to simplify the operation and avoid the occurrence of pressing the wrong function key. The left and right buttons simulate the wireless left and right mouse buttons, can realize the remote control of the computer, complete click the hyperlink, and other operations.

Which is combined with the keyboard function of key design, volume adjustment button, window switch shortcuts, and left, right selection window keys are the combination of the keyboard and the function of a single button, can realize remote volume adjustment and window switch, purpose at the same time of increasing function, avoid users complex operation, with the most simple key operation to achieve multi-function application.

It can be compatible with multi-system and multi-format file design, USB connector is designed as a combination of Type-C and USB, to solve the compatibility problem of Type-C computer, to achieve a laser pointer suitable for all operating system computers and a variety of page-turning format files, achieving more convenient, fast and versatile.

Meanwhile, in which integrated intelligent charging and protruding flange structure magnetic suction USB hidden storage design, cycle charging through nickel-metal hydride battery, convenient and more durable; hidden storage can reduce the possibility of USB loss while ensuring the product has beautiful appearance (Chen, 2003; Hou, 2020).

Hardware design of multi-use laser pen

The design of laser pen in this study mainly includes keys, roller, upper and lower shell, middle plate, laser lamp, switch, charging port, USB and storage port, etc. Its highlight is the combination of the wheel as well as the left and right keys in the mouse, and the special hollow wheel setting can achieve the page-turning by front and back and laser emission these functions. Meanwhile, clever contact on the keyboard single button and combination button convenient function, namely left and right move key, window switch button, and volume adjustment button. The body of the laser pen is equipped with a component combined with the wireless mouse and keyboard functions. Its keys include the screen switch key, left and right selection button, and volume adjustment button. The first two can realize screen switch, the latter can conduct volume adjustment, facilitating users to remotely switch the window and adjusting the volume. While realizing diversified product functions, which can also meet the requirements of compact products, simple keys, and smart operation methods.

Structure of the laser pen

The structure of wireless mouse laser pen as shown in Figure 9 to Figure 11, in which the body of laser pen is combined with wireless mouse and keyboard functions, and the keys including USB port (2), window switch button (4) (11), screen switch key (5), select key (6) (10), rolling wheel (7), volume button (9), switch (12) and charging port (13), and so on. In which the screen switch key (5) is consistent with Windows key and Tab key function which is the same with the Window10 system that can sort all Windows. The window switch button (4) (11) is consistent with the function of the left move and right move keys of the keyboard. The window can be selected in combination with the screen switch key. The left and right select keys (6) (10) on both sides of the wheel (7) can be used as the left and right wireless mouse keys with the same function without having to return to the computer to use the mouse for corresponding operations.

Among them, the rolling wheel (7) design realizes the function that only one rolling wheel can replace the original three buttons, namely the front and back page turning and laser emission. Press the rolling wheel to give the laser light (1) indication. The switch (12) and the charging port (13) are set on the side of the pen, located behind the volume adjustment button, and the laser light (1) is set on the front side of the pen. The switch is a toggle switch, "NO" indicates the boot state, "OFF" indicates the shutdown state, and the default is the "OFF" state. The charging port adopts the universal Android-type charging port, which is widely used. The volume adjustment button (9), window switch shortcut button (4) (11), and left (6) and right (10) are all combined keys and single key functions on the keyboard, which can realize remote volume adjustment and window switch. Volume button (9) to remotely adjust the volume, press the "+" button to enlarge the volume, press the "-" button to reduce the volume.

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Screen switch key (5), left window switch (4) and right window switch key (11) are a group of joint keys to jointly realize the function of switching window. When pressing the switch window (5), equivalent to the Win10 system under the task view function, namely the combination of keyboard key, Windows key, and Tab function, can make the open window order on the screen, in addition by selecting left window key (4) or right window key (11) to select the window, continue to press the window switch key (5) to jump to the selected window. The upper cover (3) and the bottom cover (8) form the outer shell of the wireless mouse laser pen, which contains the USB storage port (14) and the middle plate (15). USB storage port (14) is used to store idle USB (2), realizing the integration of USB and pen body, convenient for users to carry and store. The above seven components are set with one end of the pen body, and the other end is USB and storage port which realize the integration with laser pen and easy to store and carry.

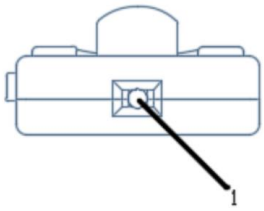

Figure 9 Side view of laser light position

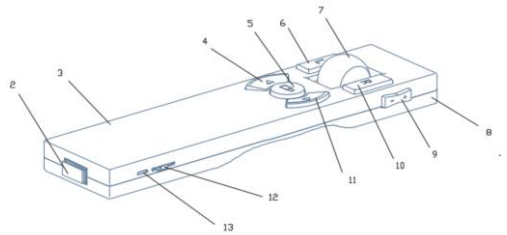

Figure 10 Main structure layout of the versatile laser pen

Note: 2. USB port**; 3. top cover; 4. left** window switch button**; 5.** screen **switch** round **key; 6.left** select **key; 7.** rolling wheel**; 8. bottom cover; 9.volume** button**; 10.right** select **key; 11.right** window switch button**; 12.switch; 13.charging port.**

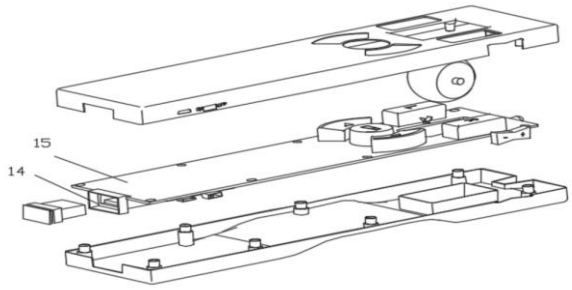

Figure 11 Diagram of multi-purpose laser pen

Note: 14. USB storage port; 15.Middle board composition.

The highlight feature of the laser pen

The multi-type laser pen has designed various combinational keys with its small shape (as Figure 12) and simple keys (as Figure 13) as well as simple operation method, It can help users in the speech process, reduce the operation of common functions of mouse and keyboard, promote the working state faster, and improve better work efficiency. Its project advantages are as follows:

The USB storage design has the features of prominent flange structure and magnetic absorption hidden storage, which is convenient for users to insertion and extraction. The USB storage port is fixed on the lower side of the middle plate and the inside of the pen body to form an integrated function of the storage port and the pen body. In addition, the hidden storage design can reduce the possibility of loss, and shape the beautiful and generous appearance of the product.

The wheel's design realizes that only one wheel can replace the original function of three keys, which can turn pages and emit laser light in front and back. The user does not need to move the finger back and forth, can try the maximum extent to avoid the wrong situation, meanwhile only need to turn the roller up and down to achieve the purpose of turning the page, and pressing the roller to perform laser indication.

The laser pen has the advantage of components combined with the wireless mouse and keyboard functions. In which the volume adjustment button (9) combines the combination of the keyboard button of Fn-key and volume amplification or reduction button function. The mouse-type multi-function rolling wheel and keyboard shortcut function are combined with the page-turning laser pen, using the multi-function rolling wheel (7) and the screen switch key (5) to realize window switching, computer's remote control, and click the hyperlink and other practical operations.

Can be compatible with the design of multi-system multi-format files, USB connector is designed as the double mode of USB and Type-C, realizing a laser pen suitable for all operating system computers and various page format files, more convenient and quick use. It has an integrated intelligent charging and remote indication function. By recycling NiMH battery, enhance the battery usage time with the advantages of high-cost performance, longer endurance, and greater power, and further solve the current situation in the current market, with the remote distance of 100 m, 2.4GHz, the wireless distance of laser range is greater than 110 m.

Figure 12 Side view of the multi-purpose wireless mouse laser pen

Figure 13 Top view of the multi-purpose wireless mouse laser pen

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5. CONCLUSION

Through the innovative design of this project, the demonstration efficiency of the demonstrator can be maximized, which is conducive to the realization of a high-quality demonstration effect, so that multimedia can play a real role in modern education. Therefore, the value of study design and development is summarized as follows:

Remote screen switch function improves the demonstration efficiency

For presenter to walk back and forth in the process of teaching, but confined to the mouse, keyboard cause inconvenience phenomenon, this product adopts the combination of the keyboard, wireless mouse, and page laser pen function, which integrates the remote screen function, volume adjustment function. The demonstrator uses the page-turning laser pen to remote control the screen, it is beneficial to improve the efficiency of presentation, in line with the innovation-driven development strategy.

Mouse rolling wheel design to create a good demonstration atmosphere

The presenter can open the hyperlink by pressing the left and right keys of the product, and insert the hyperlink in the display interface, that is, whether the video, audio, or URL, just click the hyperlink key to select, and withdraw from the mouse operation. This situation can not only improve the efficiency of the presentation content, for paying more attention to the interaction and communication with the audience, but also improving the enthusiasm and efficiency of the teaching subject and object. Good continuous interaction not only activates the atmosphere, narrates the distance between the demonstrator and the audience, but also helps the audience to deepen the understanding and give play to the subjective initiative.

USB storage design to fit the modern aesthetic

Common laser pen on the market, the USB has the defects of easy to fall off. This product has the USB and laser pen integration function such as design outstanding flange structure, receive mouth can fixed in the middle of the lower side or the inside of the laser pen. The hidden receive design can reduce the possibility of USB loss, and ensure the product beautiful and generous appearance, reflects the modern aesthetic feeling, conform to the modern aesthetic and value orientation.

Powerful compatibility function

Some of the common laser pens on the market are only compatible with Windows or Mac systems, resulting in users using the laser pen will encounter if computers with different systems that will unable to use the same laser pen. In this study, the connector was designed as a combination of Type-C and USB to solve the problem of computer compatibility. Therefore, this product can be compatible with Windows, Mac, Android, and other systems, meanwhile it can be compatible with the design of multi-system, multi-format files. It is conducive to the realization of a laser pen suitable for most computers and a variety of page format files, more convenient and fast use.

In line with the green and sustainable development strategy

In view of the problem of low capacity and fast power consumption in the market, this product optimizes the page-turning laser pen. With an integrated intelligent charging function, plug and play, no drive installation, which can activate the page-turning laser pen. The common laser pens on the market include zinc button batteries, lithium batteries, etc. After these batteries are used for a period of time, the battery aging phenomenon is serious, and the battery is rich in heavy metal element solution, which seriously endangers human health and damages the ecological environment. By the realization of nickel-metal hydride battery recycling, to enhance the use time of the battery with the advantages of high-cost performance, longer endurance, and greater power, mainly to solve the problems of fast laser pen battery power consumption, battery aging, and poor endurance in the current market, in line with the environmental protection and sustainable development strategy.

Save costs and achieve a low-carbon economy

The common laser pen in the market has a single function or complex operation can only complete the simple laser emission function or need a large number of keys to complete other functions, which cannot well achieve the original intention of making the user more convenient to operate. The laser pen designed for this product is compact, simple keys, simple operation method, no tedious operation process, to meet the needs of simple operation and easy to learn, light to use to the greatest extent. The characteristics of the five integrations of this product reducing the input of more laser pen-assisted use process product, greatly reduce the production cost, in line with promoting the construction of a conservation-oriented society.

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