ISSN 2706-655X Vol.4, Issue 4: 67-72, DOI: 10.25236/IJFET.2022.040409

Design of Engineering Precision Measurement Device in 5G Era

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Abstract: *Measuring device is a tool for measuring land planning or building, and the measuring device is applicable to a wide range. This paper designs a kind of urban and rural planning measurement device, including detection device main body, drawing side instrument base, fixed bolt and fixed block, said detection device main body is installed at the bottom of the detection device bracket, and the detection device main body is provided with a hydraulic rod, and the hydraulic rod is connected to the top of the support frame, while the support frame is connected to the fixed block through the pin, said fixed block is connected to the limit block through the resistance spring, and the fixed block The top of the fixed block is connected to the driven gear, and the top of the driven gear is connected to the side plotter bracket, and the side plotter bracket is connected to the base of the side plotter through a U-shaped slot. When the drawing side instrument body needs multi-angle drawing, you can rotate the drawing side instrument body by hand, so that the rotating drawing side instrument body rotates between the drawing side instrument bracket and the support frame, so that the drawing side instrument body can rotate freely, so that the drawing side instrument body can be drawn at all angles, which is conducive to improving the efficiency of the staff when drawing.*

Keywords: *Measuring Device; Rotate Freely; All Angles; Efficient*

1. Introduction

The current urban and rural planning engineering measurement work has made great progress [1], and the urban and rural planning system is constantly improving, the professional quality of planning personnel is also improving, but specifically to the urban and rural planning engineering measurement device, there are still many problems [2]. First of all, the measurement tool color function form single, the current market common measurement tool is mostly yellow, the color is relatively single, and the structure is mostly integrated, affecting the cost of transportation [3]. Secondly, the environmental adaptability of the measurement tool is weak, the product is more repetitive, and manufacturers of engineering measurement instruments are roughly the same in nature construction [4]. And the accuracy of the measurement device is low, the traditional engineering measurement device because of the changes in the external environment, the technical level of the observer and the construction of the instrument itself is not perfect, causing errors in accuracy [5]. At present, there are still more problems with engineering measurement devices, which need to be solved by reasonable technical means [6].

This design can ensure that the final product can greatly improve the efficiency and customer acceptance compared with the traditional engineering measurement device. The design is reasonable, thorough and feasible in solving the problem of engineering measuring instrument variation, which can make the measuring work completed smoothly, reduce the waste of human and material resources, and ensure the rigorous measuring work.

2. Design Introduction

2.1. Design overview

Engineering construction planning and design, construction and management phase of measurement work required for a variety of orientation, distance, angle, height, map and photogrammetry instruments

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[7].

Theodolite is an instrument for measuring horizontal and vertical angles. It is composed of telescope, horizontal and vertical dials and base and other components. According to the reading equipment is divided into vernier theodolite, optical theodolite and electronic theodolite. The theodolite is widely used for control, topography and construction release and other measurements. There are six models of China theodolite series: DJ07, DJ1, DJ2, DJ6, DJ15 and DJ60. When special accessories are attached to the theodolite, it can be composed of: laser theodolite, slope Theodolite, etc.

The level is used to measure the height difference between two points. It is composed of telescope, level and base and other components. According to the structure is divided into fixed mirror level, turn mirror level, micro-tilt level, automatic leveling level. Level meter is widely used in control, topography and construction release and other measurement work. The series standards of Chinese level meter are: DSO5, DS1, DS3, DS10, DS20 and other models. When special accessories are attached to the level, it can form a laser level.

Electromagnetic wave rangefinders use electromagnetic waves to carry distance measurement signals to measure the distance between two points. The range of 5~20 km is called medium range range meter, and the range within 5 km is short range meter. Since the 1960s, the rangefinder has developed rapidly. In recent years, the production of two-color precision photoelectric rangefinder accuracy has reached 0.1mm + 0.1ppm. electromagnetic wave rangefinder has been widely used in the control, topography and construction release measurement, multiplying the field work efficiency and distance accuracy.

Electronic speed measuring instrument consists of electronic longitude and latitude meter, electromagnetic wave distance meter, microcomputer, program module, memory and automatic recording device, which quickly performs distance measuring, angle measuring, calculation, recording and other multi-functional electronic measuring instruments. There are two types: integral and combined. Integral electronic tachometer is a combination of all functional parts, which can automatically display the slope distance, angle, automatically calculate and display the flat distance, height difference and coordinate increment, with a high degree of automation. Combined electronic tachometer, that is, electronic latitude and longitude meter, electromagnetic wave rangefinder, computer and mapping equipment and other separate components, according to the needs of the combination, both higher automation characteristics, but also have greater flexibility. Electronic tachometer is suitable for engineering survey and large scale topographic survey. And can provide analysis data for the establishment of digital ground model, so that the ground measurement tends to automation, but also can do tracking measurement of active targets, for example, for the port project of the ship in and out of the port track observation.

The gyro-latitude instrument combines a gyroscope and a longitude and latitude instrument to determine the true azimuth. It can be used in the latitude range of 75 ° from north to south on the earth. When the gyroscope rotates at high speed, its axial meridian surface swings back and forth on both sides due to the influence of the earth's rotation. By observation, the true north direction can be fixed. The gyro meridian is mainly used for the orientation work of underground conductor measurement in mines and tunnels. Some of the gyro meridians are controlled by microprocessor, and the measurement results are displayed automatically with high measurement accuracy. The laser gyro warp has the characteristics of high accuracy, stability and low cost.

Laser measuring instruments are various measuring instruments equipped with a laser transmitter. There are more instruments of this type, which have in common a helium-atmosphere laser connected to a telescope, which directs the laser beam into the telescope barrel and coincides it with the axis of visual alignment. Using the advantages of good directionality of the laser beam, small emission angle, high brightness, and red visibility, a sharp collinear line is formed and used as the basis for orientation and positioning. It is widely used in large building construction, trench and tunnel excavation, large machine installation, and deformation observation and other engineering measurements.

The liquid static level is an instrument that uses a connecting tube to determine the small height difference between two points. It is mainly an observation system composed of a depth sounder and a controller. The former uses micro-motor as the power to automatically track the water level by stylus for observation, and the latter by electronic equipment parts through the depth meter and sink point wired connection, command any sink point to work, and by digital tube display the observation value of each point. Under good conditions, the observation accuracy can reach about 0.05mm. The instrument is mainly used for precise determination of building settlement, building installation and tilt observation in earthquake forecasting.

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Photographic theodolite assembled by the camera and latitude instrument for ground photogrammetry field operations with the main instrument. The camera has objective lens, dark box, film frame, and shadow checker. The frame is equipped with a precise frame mark. Longitude and latitude meter is used to determine the coordinates of the photographic site and checkpoint, and determine the direction of the main optical axis. It is mainly used for topographic and non-topographic photogrammetry.

Stereo coordinate measuring instrument is used in photogrammetry to determine the right angle coordinates and coordinate difference of the image plane of the same name point on the stereo image pair. It is composed of observation system, guide system, image plate, measurement system and lighting equipment. Some instruments have automatic coordinate recording device, and also can directly obtain the computer use of perforated paper tape, or equipped with automatic image of the measured image points of the device. Mainly used to analyze the air triangulation and ground stereo photogrammetry encryption image control points.

Stereo mapper is the main instrument for photogrammetry internal mapping. Its structure principle is based on the geometric inversion of the photographic process. It is composed of projection system, measurement system, observation system and mapping system. The instrument is divided into optical projection, mechanical projection and optical-mechanical projection according to the projection method. At present, the trend of development is that the structure of the mainframe tends to be simple, but various peripheral devices are added, such as automatic coordinate recording device, orthographic projection device, CNC drafting table, etc., in order to expand the scope of use and improve the efficiency. In addition, the analytical mapping instrument can also be classified as an all-round mapping instrument, which consists of a high-precision stereo coordinate measuring instrument with feedback system, an electronic computer, a CNC drawing table, a console and the corresponding software. The new analytical mapper can be online or offline mapping, and its man-machine dialogue digital photogrammetry, information library and graphical interpretation system is used for cadastral survey and aerial triangulation, which can obtain digital ground model, cross-sectional map, ground photogrammetry and repair and update map.

2.2. Design Innovation

The design consists of a detection device main body, pan tilt, drawing side instrument base, a fixed bolt and a fixed block, a detection device bracket is installed at the bottom of the detection device body, and a hydraulic rod is installed inside the detection device body, a support frame is connected to the top of the hydraulic rod, the support frame is connected to the fixed block through a pin, the fixed block is connected to the limit block through a resistance spring, and the top of the fixed block is connected to the driven gear, and the top of the driven gear is connected to the drawing side instrument bracket, and the drawing side instrument bracket is connected to the drawing side instrument base through a U-shaped slot.

Compared with the traditional protective fence device, this design breaks the characteristics of engineering measuring instruments, the whole device is simplified to the design of disassembled installation, through the stability of the pan tilt, high-precision measuring instruments, so as to achieve the product space minimization measurement accuracy maximization. At the same time to change the traditional engineering measuring instrument color and material single problem, detachable design can not only play a role in improving space utilization, but also can reasonably save resources and play a multi-functional measurement role.

Figure 1: First generation product model display

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Figure 2: Second generation product model display

This design adds the design of detachable pan tilt, which improves the stability of the device and simplifies the installation method, saving human resources to a certain extent. And because of the small size of the design, it is easy to transport and can save transportation costs.

3. Technical introduction

3.1. Device dismantling technology

This design is based on the patent for utility model for technical support, including detection device main body, pan tilt, painted side meter base, fixing bolt and fixed block, detection device detection devices are installed at the bottom of the main body bracket, detection device main body set inside the hydraulic rod, and hydraulic bar at the top of the connections with brace, brace by bolt connected with the fixed block, The fixing block is connected with the limit block by a resistance spring, and the top of the fixing block is connected with the driven gear, the top of the driven gear is connected with the drawing side instrument bracket, the drawing side instrument bracket through the U-shaped groove and the drawing side instrument base. The design maximizes the use of time, space and human resources through device disassembly technology.

3.2. Equipment replacement technology

The device disassembly technology enables this design to keep pace with the equipment of engineering testing devices. Nowadays, with the passage of time and the culmination of the information age, the accuracy of engineering measurement device equipment is becoming more and more accurate, and the device replacement technology enables this project to still stand out in the high voltage market competition industry, whether it is a manual measurement subject or an electronic infrared measurement subject to get the best experience in this design.

3.3. Pan tilt technology

Pan tilt stabilization principle: no matter how the body vibrates, the pan tilt can filter out most of the vibration and maintain the relative position of the lens to the ground does not move. The main sensors that need to be used are IMU and motor magnetic encoder. Installed on the lens and the lens fixed connected imu, used to obtain the lens to the ground of the three-axis angular velocity Gyro and three-axis acceleration Acc, each motor shaft installed on the magnetic encoder to obtain the angle of each axis of the pan tilt, the imu to obtain the Gyro angular velocity for integration, can get the lens rotation angle, and then reverse the corresponding angle adjustment motor, can realize the pan tilt stabilization.

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4. Risk Analysis and Solutions

4.1. Technical Risk Analysis

4.1.1. Technology Development Risk

At present, the technologies and strategies related to web development have been developed quite maturely, and the theories of data mining techniques and optimal algorithms for requirements analysis are abundant, and examples of clientless instant online games are common. However, since no real implementation of the program has been carried out yet, there are still many uncertainties and some unpredictable development problems will be encountered in the process of algorithm program implementation. In addition, due to the lack of funds in the initial stage of the project team, hiring a large number of part-time developers will lead to instability of the technical development team, which will easily lead to the website development not being carried out smoothly.

4.1.2. Service Risk

The quality of service is a decisive factor in whether the website can retain customers. If the technology cannot be better improved to adapt it to the actual needs, it will be possible to lose valuable users and the website will not be able to develop. In addition, for many specific service projects within the project team, there are many uncertainties, and the staff is still not experienced enough to handle them properly, which will lead to a decline in the reputation of the project team.

4.2. Technology Risk Countermeasures

4.2.1. Countermeasures against technology development risks

The first step in building the website is to form a strong and experienced project team to further improve the algorithm, ensure its feasibility and stability, and hire experts in the field to gatekeep the program. Increase investment in technology, including personnel and equipment, to ensure smooth development. At the same time, the stability of the development team's personnel should be maximized, and contingency measures should be in place even if there is a disconnect.

In addition, for the design of the website interface, we will also play our professional knowledge and form a strong team with professional aesthetics, for website planning, website interface design for strict control, the use of aesthetic elements to the extreme.

4.2.2. Countermeasures against service risks

In order to have a satisfactory service quality in the market, we need to arrange a few months of testing before the website is officially run, and carry out the process of breaking in the algorithm program in actual operation. In addition, we need to hire some market researchers to investigate the operation of the site, to identify problems and adopt the user's opinion to make the site more user-friendly.

5. Conclusion

This paper designs an urban and rural planning measurement device, including the main body of the detection device, the base of the drawing side instrument, the fixing bolt and the fixing block. This design is easy to install between the plotter and the support frame when field exploration is carried out, and also the installation is solid, which enables the plotting of multiple angles at the same place during the survey. When the main body of the plotter side instrument needs multi-angle plotting, the main body of the plotter side instrument can be rotated by hand, so that the main body of the rotating plotter side instrument can be rotated freely by rotating between the plotter side instrument bracket and the support frame, so that the main body of the plotter side instrument can be plotted at all angles, which is conducive to improving the efficiency of the staff when plotting.

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