Design of Simple Wind Speed and Direction Measurement Instrument Based on Single Chip Microcomputer

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Abstract

The development history of human society and the discovery and application of energy are closely related. Each application of new energy can have a great impact on the development of human society. On the earth, wind energy is a resource that can be produced many times, does not pollute, and has abundant reserves. This paper introduces a wind speed and direction tester which is used to measure the speed and direction of the wind by a single chip microcomputer and display the wind speed and direction in real time. The system uses photoelectric switch to collect wind speed and calculates wind speed by single chip microcomputer technology. The measured wind speed is displayed on the digital display screen in real time. For the wind direction, the system uses the wind vane to measure and collect the wind direction signal, then uses the gray code plate to convert the wind direction data into gray code, and then converts the gray code into the corresponding wind direction through the single-chip microcomputer, and finally displays the measured wind direction data through a digital tube. Module programming is used to design the software part to facilitate maintenance and improvement in the future.

Keywords

Wind direction; wind speed; single chip microcomputer.

1. Introduction

As a clean and recyclable energy, wind energy plays an active role in transforming the mode of economic development in China. Wind data is an important information, which is indispensable in our national economic construction. In the new period, the accuracy of wind speed and direction measurement is also required to be higher.

At present, most of the wind speed and direction are measured by mechanical method. The measuring speed is slow and the measuring accuracy is poor. The design uses a single-chip microcomputer and photoelectric switch, measuring speed is fast, measuring accuracy is high, to enhance the level of product science and technology is of great significance.

This paper mainly explores how to measure the wind speed and direction automatically. The microcontroller and photoelectric switch are used to realize the real-time measurement of wind speed and direction with high speed and high precision.

2. Wind Speed Direction Tester

Domestic situation: most of the automatic weather stations in China still use the past mechanical wind measurement technology. Ultrasonic wind measuring equipment abroad has gradually entered China's market and gradually matured. But our country has not been able to develop high-end ultrasonic technology wind measurement equipment, also become the pain of our equipment manufacturing industry. But domestic research in some aspects of higher scientific and technological content, such as:

1) differential pressure flowmeter 2) impeller flowmeter 3) volumetric flowmeter (variable pressure drop flowmeter) 4 magnetic current meter 5) ultrasonic vortex flowmeter. However, due to cost reasons, it has not been widely applied.

Current situation abroad: At present, the ultrasonic wind measurement system as a popular wind measurement system in foreign countries to be studied and developed, and gradually mature. In addition to the ultrasonic wind speed tester, there are also the wind speed and direction tester of the whole microcomputer control tester and the wind speed tester of the thin film platinum resistance.

3. Wind Direction Detection Part

Gray (Gray code) is a reliable code. Gray codes are called reflective binary codes and cyclic binary codes. As a coding method, Gray codes can minimize errors. This is because in some special cases, such as from decimal 3 to 4 when each bit of the binary code changes, so that the digital circuit produces a large peak current pulse. However, Gray code does not produce such a situation, all adjacent integers in their digital representation only one number is different, which is its advantage as a digital sorting system, it can achieve logical transformation when the signal confusion, in any two adjacent numbers between the conversion, only one digit changes.

The test elements of wind direction sensor are single-board wind vane, Gray code disk, photoelectric switch, single-chip microcomputer and digital tube display. A four bit gray code photoelectric encoder is used to measure the wind direction. The wind vane is connected with the main shaft, and the wind drives the wind vane to rotate. For each 22.5 degree rotation, a new set of four-bit parallel gray codes will be generated on the photoelectric switches and receivers on the gray code plate. The gray code plate will transmit the gray code to the single chip computer, and then convert the gray code into the wind direction angle through the single chip computer. Finally, the microcontroller outputs to the digital tube display to display the real-time wind direction.

4. Wind Speed Detection Part

The main component to get the wind speed is the wind cup, the size of the wind cup is determined, from which we can get the distance of the wind cup rotating one circle. We use optoelectronic components to measure the number of turns per minute of the wind cup, write a single-chip microcomputer program, convert the number of turns to the distance of the wind cup rotation, and then divide the distance by time, we get the speed of the wind in every minute. We use very light materials to make cups, which can reduce the consumption of wind energy and make wind speed measurement more accurate. When the cup passes over the top of the photoelectric switch, the reflective paste reflects the light. The receiving element receives the reflective light and generates a pulse signal. The counter calculates the number of pulses, and then transmits the number of pulses (cycles) to the microcontroller. The microcontroller calculates the rotational speed through the program and transmits it to the digital tube display. Wind speed.

5. Power Configuration

The power supply design in this paper not only considers the power supply mode of the system, but also considers the economy and durability of the power supply, so the system uses the city power supply mode, overcomes the shortcomings of battery power supply, good economy, and environmental protection, saving costs. But the city power also has the shortcomings of high voltage and instability, and the city power is alternating current, can not be used directly, must be converted to direct current, so the system uses a dedicated power circuit.

In order to ensure that the system can obtain reliable current, we choose 220V-12V transformer, and then use diode full bridge rectifier to rectify the current, the negative current is integrated into the positive. In order to achieve the goal of rectification safety, the rectifier current flowing through the

diode should be less than the maximum rectifier current, and the diode reverse work. The peak voltage should be half or two-thirds of the reverse breakdown voltage. The 2C12D diode is used in this system. The capacitor of the filter circuit is large, so the electrolytic capacitor is used, which has polarity, and the voltage withstand should be considered when choosing. In order to realize the voltage stability, avoid the measurement and calculation errors and ensure the stability of the control device, the integrated regulated power supply W7805 is adopted. When used, only one capacitor in parallel between the input terminal and the lot is needed to prevent self oscillation.

6. Summary

This paper designs a wind speed tester which can measure wind speed and direction accurately and has high reliability. It is helpful to the development of wind data measurement and improves the accuracy and speed of wind data measurement to a greater extent.

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