

Intelligent inverter solar antifreeze system based on STM32

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Abstract

This project is designed to be an efficient new type of intelligent control solar antifreeze equipment, which is mainly suitable for all traditional household solar water heaters in urban areas. Thermal circulation system, and through the intelligent frequency conversion power supply system to prevent the freezing pipes from starting and stopping by themselves, the intermittent heat supply method uses the thermal energy stored in the solar energy to carry out the circulation system, which can prevent the pipes from freezing due to low temperature. Even the problem of cracking the pipe, and the work is ended by manual water and electricity cut off after about eight hours of work. Save electricity, reduce consumption, operate safely and greatly reduce pollutant discharge, so as to protect the environment and sustainable use of renewable resources, and for different weather conditions, the temperature inside the water heater is higher and the temperature inside the water heater is lower. Different methods can be used to deal with the situation, and the methods are relatively complete, so as to minimize the error probability caused by human factors.

Keywords

STM32 microcontroller · DHT11 temperature and humidity detection module · pressure sensor · GSM data transmission.

1. Introduction

The system consists of DHT11 temperature and humidity sensor, control system, air pressure sensor, frequency conversion PID controller and other circuits. The DHT11 temperature and humidity control sensor measures the temperature in the pipeline. When the ambient temperature is lower than the freezing condition, the information is fed back to the control module. The controller module can use the remote control of the circuit to achieve the purpose of controlling the flow of hot water in the anti-icing conduit. At the same time, the device is equipped with an air pressure sensor to measure the air pressure in the pipe, and the pressure sensor feeds back the information to the PID circuit of the automatic frequency converter. After the data processing of the circuit, it will feed back a piece of information about increasing or decreasing the amount of water to the controller module to realize frequency water supply. Then the WiFi module transmits the signal to the central host, stores the data, and connects to the network at the same time. Users can view it on the APP and other clients, making it more convenient and fast.

In terms of processor, we have adopted the STM32 single-chip microcomputer with high development and high compatibility, which reduces the cost while ensuring high-level compatibility. In today's environment where STM32 chips are widely used, our more in-depth development of STM2 makes the combination of hardware and hardware simpler and faster, and has lower operational requirements.

In order to better adapt to various environments, we installed solar panels on the equipment, and installed a 30,000mAh lithium battery inside. After actual monitoring, it can run for more than 73 hours in a dark environment. When there is sunshine, the solar charging panel works to charge the battery and supplement the battery life.

In order to cope with the environmental changes under various temperature, humidity and other conditions, this equipment chooses two methods to deal with the situation that the internal temperature of the water heater is high in sunny days and the internal temperature of the water heater is low in rainy weather conditions. The probability of temperature error caused by factors is minimized. The output power of the electric heating cable is generally controlled by the heat transfer process, and the output power is adjusted according to the working temperature of the heater system, but the conventional constant power heater does not have this capability.

2. The overall structure and principle of the system

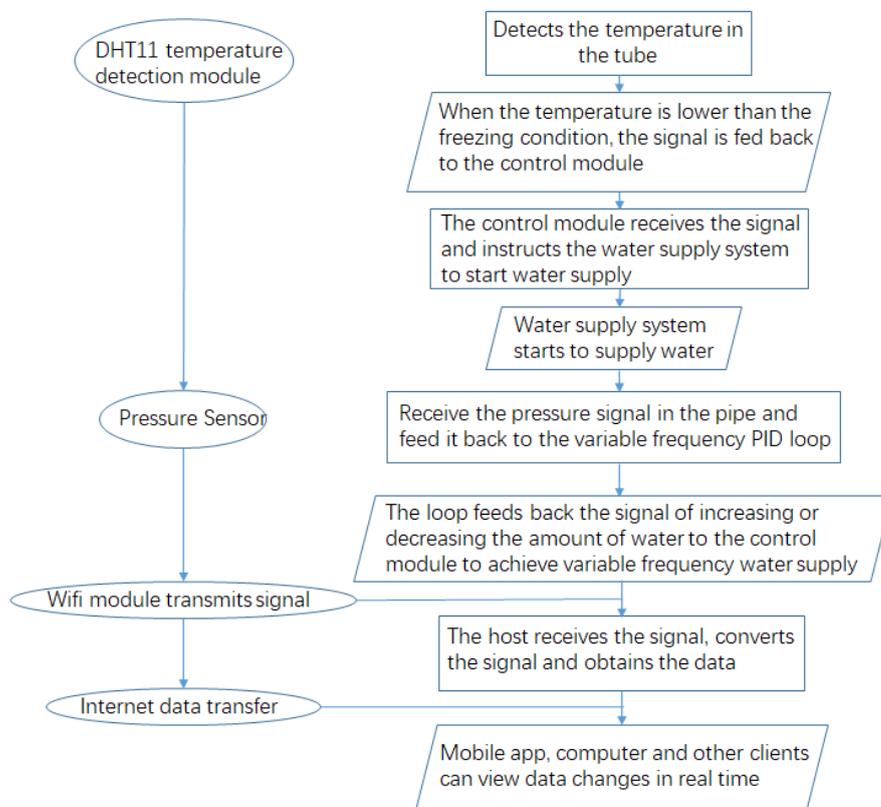


Fig. 1 Working flow chart of intelligent inverter solar antifreeze system based on stm32

When the temperature detection system detects that the temperature in the pipeline is below the set value, it will transmit the signal to the control terminal through the control route, and the control terminal will control the power supply of the antifreeze device to start. When the temperature detection device detects that the temperature in the electric water heater is high, The signal will be transmitted to the single-chip microcomputer, and the anti-freezing pipe controlled by the single-chip microcomputer starts to pass hot water to work. At the same time, the frequency conversion water supply system starts to operate. As the water consumption increases, the frequency increases, the pump speed increases, and the water supply volume increases accordingly. Fill the antifreeze pipe with hot water. Then the water consumption will decrease, the frequency will decrease, the speed of the pump will slow down, and the water supply will decrease accordingly, until the pipe is filled with hot water, that is, the water supply will be stopped. The temperature detection device continuously monitors, and repeats the above steps when the temperature of the hot water drops to the set value.

1. Pressure sensor:

Taking advantage of the high conductivity of rainwater, it is possible to test whether there is rain or snow by measuring the circuit.

2. DHT11 temperature and humidity sensor

DHT11 temperature and humidity sensor is a comprehensive sensor with calibration data signal. It has a professional data module collection method and a temperature and humidity sensing method, so it has high security and long-term stability. The sensor contains a resistance type humidity sensing device and an NTC type temperature measuring device, which are connected by a group of advanced eight-bit single-chip microcomputers. Therefore, it has the advantages of excellent quality, ultra-fast response, strong anti-interference performance, and market price ratio. It is a low-cost sensor suitable for a variety of applications.

DHT11 sensor products can be calibrated in a very precise air humidity detection room. The correction coefficient is stored in the OTP storage in the form of a program, and the sensor needs to adjust the correction coefficient in the process of measuring data. The single-wire serial interface makes its implementation more concise and convenient. Ultra-small weight, low power, and communication transmission length of more than 20 kilometers, making it an excellent choice for various occasions and even harsher use occasions.

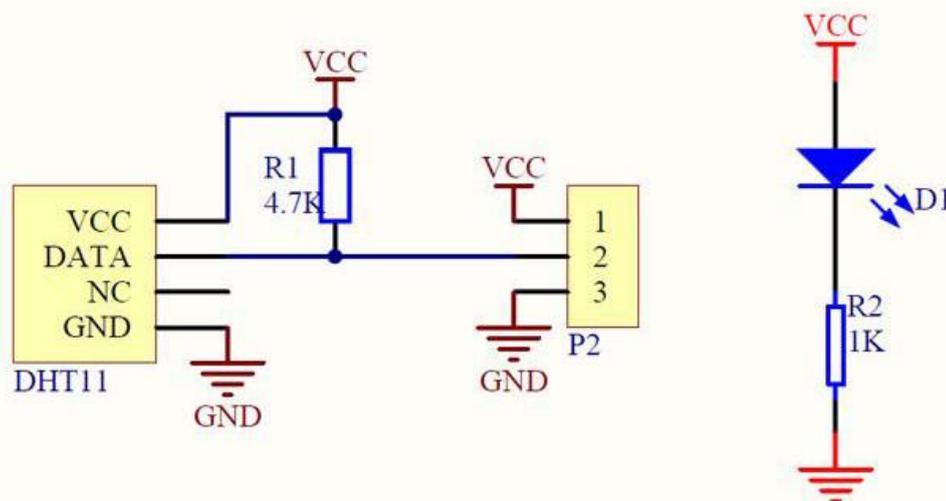


Figure 2 Working principle diagram of DHT11 temperature and humidity sensor

3. The low power consumption SIM900A module is added to the system, and the related Global System for Mobile Communications (Global System for Mobile Communications), abbreviated as GSM, enables the system to transmit the corresponding data to the user's mobile phone.

Its characteristics are as follows

- 1) Low power consumption: less than 18mA in standby mode, less than 2mA in sleep mode
- 2) Wide power supply range: 3.2~4.8V
- 3) Support frequency band: GSM/GPRS 900/1800MHz
- 4) Voice transmission: support 0.5 rate, full rate, enhanced rate
- 5) Support echo control algorithm, which can adjust the echo suppression value according to the AT commands used by different client devices to eliminate
- 6) The biggest advantage of the module is that it can retain 232 ports, and can monitor the operation status of 51 low-end microcontrollers and module instructions during machine learning and development, and can find the cause of errors faster, thus saving research and teaching time and supports 2, 3, 4G mobile phone cards.

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