



# Design of Sealing Transformer for Vacuum Packaging Machine Based on Single Chip Microcomputer Control

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**Abstract.** In order to realize the voltage conversion control of vacuum packaging machine seal, a design method of vacuum packaging machine seal transformer based on MCU control is proposed. The main function modules of the system are vacuum packaging machine seal physical index collection module, integrated control module, upper computer communication module, program control module, transformer load balance control module, human-computer interaction module, etc. In the intelligent auxiliary control system, the program cross compiling design of the sealing voltage conversion control of the vacuum packaging machine is carried out, the voltage conversion control is identified in the sealing process of the vacuum packaging machine, the characteristic quantity of the sealing transformer of the vacuum packaging machine is extracted, the human-computer interaction design of the sealing transformer of the vacuum packaging machine is carried out by using the visual operation and maintenance information management method, and the DSP is integrated. The information transmission control of the sealed transformer of the vacuum packaging machine is realized. The simulation results show that the designed sealed transformer of vacuum packaging machine has good reliability and strong adaptive control ability, and improves the sealing pressure control ability of vacuum packaging machine.

**Keywords:** Single chip microcomputer · Control · Vacuum packaging machine · Sealing · Transformer

## 1 Introduction

The vacuum packing machine can automatically extract the air packing bag, which can be filled with nitrogen or other mixed gases in the process after the extraction is sealed and the predetermined vacuum is achieved. And vacuum packaging machine is often used in the food industry, vacuum packaging, so that food can be antioxidant, so as to achieve the purpose of long-term preservation. The vacuum degree in the food container packaged by the vacuum packaging technology of the packaging machine is generally 600–1333 Pa. Vacuum packaging is also referred to as a reduced pressure package or an exhaust package. The pressure swing control design of the vacuum

packaging machine is required, The embedded control technology is adopted to optimize the design of the vacuum packaging machine for the sealed transformer, and the intelligent monitoring level of the vacuum packaging machine is improved [1]. The design of the vacuum packaging machine related to the design method of the sealed transformer is of great significance for power transmission and distribution and the optimization of the power grid. The design method of vacuum packing secret seal transformer has always been the focus of people [2, 3]. Firstly, the design method of the sealed transformer is used to study the vacuum packaging machine. The vacuum packaging machine of the sealed transformer designed with the overall structure is the first. Then, the vacuum packaging machine of the sealed transformer is developed and designed with the function module of the seal, which is combined with the embedded development technology [4]. The design of vacuum packing secret seal transformer is realized, and the simulation test is analyzed, and the effectiveness conclusion of is obtained.

## 2 The Overall Design Framework of the System

In order to design a sealing transformer of a vacuum packaging machine, a system structure model of an integrated intelligent monitoring system of a vacuum packaging machine needs to be first analyzed, a software development of a sealing transformer of a vacuum packaging machine is carried out in combination with an embedded cross-compiling method, the development control of the sealing transformer of the vacuum packaging machine is carried out, the embedded control module of the sealing transformer of the vacuum packaging machine is established, the integrated design of the sealing transformer of the vacuum packaging machine is carried out through the function modularization analysis and the integrated video information processing method, the sealing transformer of the vacuum packaging machine is built on the embedded control platform, the embedded B/S framework method is adopted, the program control of the sealing transformer of the vacuum packaging machine is carried out, and the intelligent control and integrated information processing capability of the sealing transformer of the vacuum packaging machine is improved. The main functional module of the system is provided with a vacuum packaging machine sealing physical index acquisition module, an integrated control module, an upper computer communication module, a program control module, a transformer load balance control module, a human-computer interaction module and the like, the overall structure of the resulting system is shown in Fig. 1.

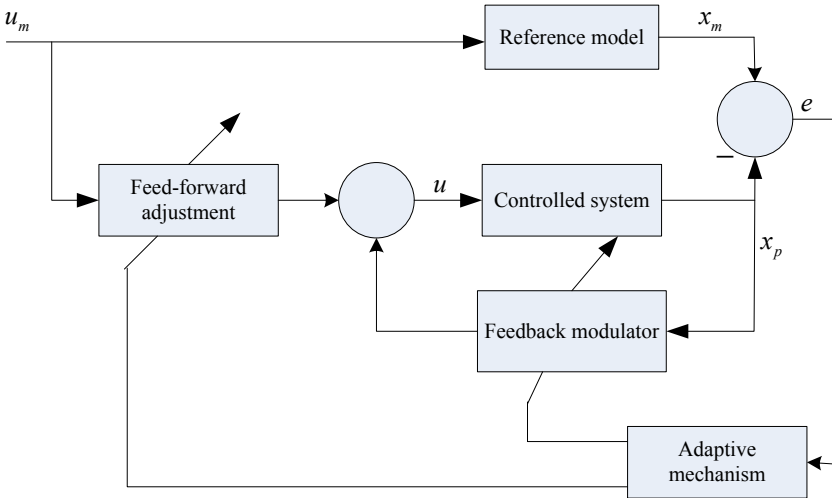


Fig. 1. General framework analysis of the system

According to the overall structure analysis of the sealing transformer of the vacuum packaging machine of Fig. 1, and the cache control of the pressure swing control of the vacuum packaging machine is carried out in the cache component, and the process control capability of the pressure swing control of the vacuum packaging machine is improved.

### 3 Analysis of the Function Module of the System

#### 3.1 System Function Module Analysis

On the basis of the overall design of the sealing transformer of the vacuum packaging machine, the component design and the hardware development environment analysis of the sealing transformer of the vacuum packaging machine are carried out, the dynamic range of the multi-channel data record of the vacuum packaging machine control information acquisition is set to  $-10$  dB to  $+10$  dB, the configuration of the Linux kernel is a large amount of 120KB, the ISA/EISA/Micro Channel expansion bus is adopted to carry out the command loading of the pressure swing control of the vacuum packaging machine, the integrated control method is adopted to carry out the hardware modular design of the pressure swing control of the vacuum packaging machine, the program loading of the pressure swing control of the vacuum packaging machine is carried out by adopting a single-chip microcomputer logic command control method, the output bus control of the sealing transformer of the vacuum packaging machine is controlled by adopting a voltage impulse response control method, and the man-machine interaction interface module is constructed [5], and the data storage center is provided with a vacuum packaging machine, a pressure swing control and a man-machine interaction design, an output bus control module is established, and the man-machine interaction and the cross-compiling of the sealing transformer of the vacuum packaging machine are carried out (Fig. 2).

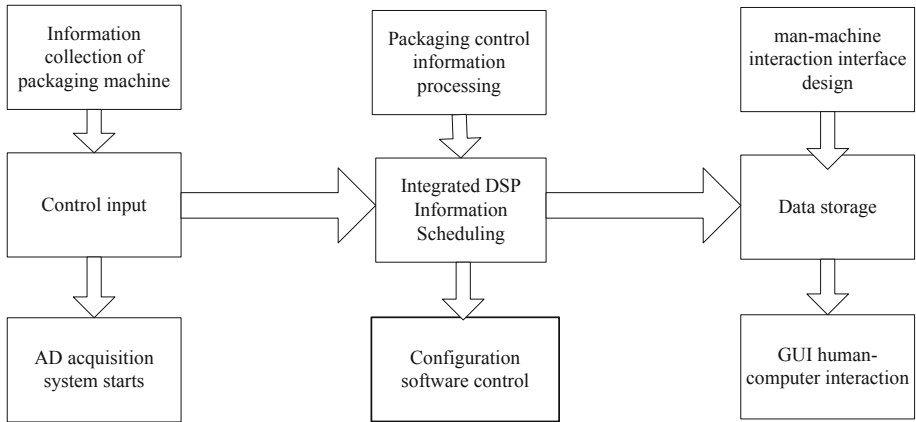


Fig. 2. Functional module structure of the system

### 3.2 Working Principle and Design of Control Circuit

Negative feedback control system is mainly controlled by switching power supply, and the design of main control links is very important. This paper mainly controls the charging system of the power battery of the sealing transformer of the vacuum packaging machine. The specific control methods are the inner loop control, the voltage outer loop control and the double loop control. When the power device is on or off, the main circuit is affected by different circuit topologies and exists as a nonlinear system. In the process of engineering design, it is necessary to get the equivalent circuit model of low frequency according to the average method of state space, and then design the regulator according to the existing performance index. In order to get better dynamic and static effects of the transformer, the negative feedback combination of voltage or current is often used in the design.

#### 3.2.1 Main Control Circuit

The main control circuit consists of four parts: (1) Current control return. (2) Charging current and capacity display circuit. (3) Test sampling circuit. (4) Alarm circuit. Because of various factors in the circuit, switching power supply is very easy to fail. Therefore, when selecting the type and type of switch, it is necessary to carefully consider and select according to the actual situation of the circuit.

#### 3.2.2 Transformer

When choosing transformer, we must use high frequency transformer. The performance of this transformer is relatively good, but it has higher requirements for the use of magnetic materials. The transformer can give stable voltage output to the circuit, so that the circuit can reduce the voltage impact when it works.

### 3.2.3 Capacitor

Due to the different frequency of the power supply, the loss of the common capacitor is quite large for the power supply with high frequency, and the inductance also increases. With the increasing frequency, the attenuation phenomenon is very obvious, which can not meet the normal use requirements. Therefore, when selecting capacitors, it is necessary to decide whether to select special capacitors according to the actual situation of the circuit, so as to meet the requirements of high frequency and high temperature resistance, so that the circuit can run stably.

### 3.2.4 Single Chip Microcomputer

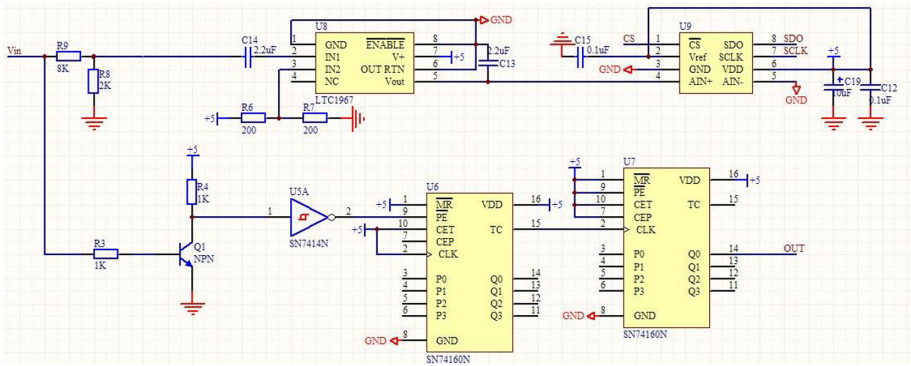
When the system is powered on, the SCM will test the power supply and charger. When the power supply and charger are working normally, the single chip microcomputer will feed back the detection sampling to the internal system, and finally decide which charging form to use, which has reached the charging requirements. PWM pulse width can effectively control the whole process of charging, so that trickle, large current, overcharge and floating charge are all under control. When multiple tests are carried out, it is found that the battery voltage is higher than the specified voltage set in the single chip microcomputer, or the temperature is higher than the preset temperature, so the floating charge state is turned on and an alarm is given at the same time.

## 4 System Design and Implementation

By the analysis of the overall design framework and function modularization of the sealing transformer of the vacuum packaging machine, the components of the sealing transformer of the vacuum packaging machine are developed and designed. This paper puts forward the design method of the sealing transformer of the vacuum packaging machine based on single chip microcomputer [6–10]. The main functional modules are the acquisition module of the sealing physical index of the vacuum packaging machine, the integrated control module, the communication module of the upper computer, the program control module and so on [11].

### 4.1 Physical Index Acquisition Module of Vacuum Packaging Machine Sealing

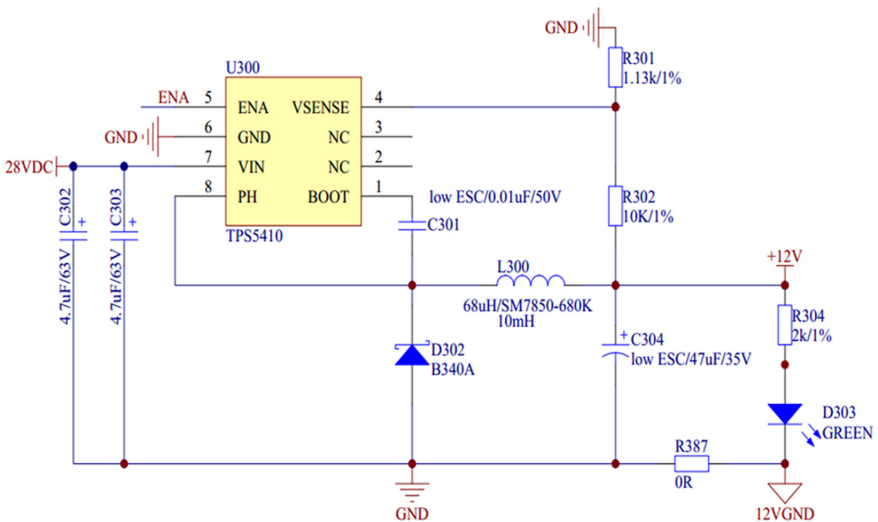
The sealing physical index acquisition module of the vacuum packaging machine realizes the data information collection of the sealing transformer of the vacuum packaging machine, the sealing physical index collector of the vacuum packaging machine adopts a sensor device, and the sealing physical index acquisition of the vacuum packaging machine is carried out in the embedded bus [12], the invention adopts the ADSP-BF537BBC-5A to realize the integrated information processing of the pressure swing control of the vacuum packaging machine, and the error disturbance suppression in the process of collecting the physical index of the sealing physical index of the vacuum packaging machine is carried out, and the hardware design of the sealing physical index acquisition module of the vacuum packaging machine is obtained as shown in Fig. 3.



**Fig. 3.** Hardware construction of acquisition module for sealing physical indexes of vacuum packaging machine

### 4.2 Integrated Control Module

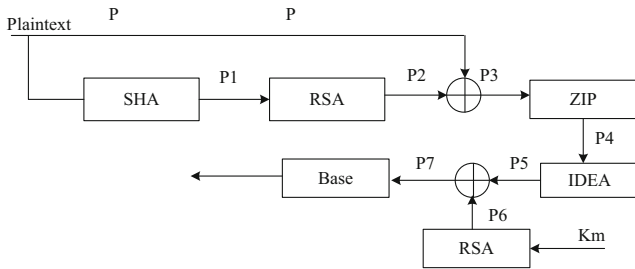
The integrated control module realizes the bottom control function of the pressure swing control of the vacuum packaging machine, in that intelligent auxiliary control system, a three-dimensional ICAD platform design of the seal transformation control of the vacuum packaging machine is carry out [13–16], the program cross-compile control is carried out according to the characteristic of each front end equipment of the system, the system adopts the ADM706 chip design threshold detector, and through the design, the system configuration of the integrated control module is obtained as shown in Fig. 4.



**Fig. 4.** Design of integrated control module

### 4.3 Network Networking and Human-Computer Interaction

In the embedded Linux platform, the image control and the information transmission of the pressure swing control of the vacuum packaging machine are carried out, the program loading of the pressure swing control of the vacuum packaging machine is carried out by adopting the method of the logic command control of the singlechip [17], the embedded man-machine interaction design is carried out by using the GPRS module, Windows Server 2012 R2 system is installed for man-machine interaction and interface design, cloud storage is carried out in the remote server, and the network networking and man-machine interaction design of the pressure swing control of the vacuum packaging machine are obtained as shown in Fig. 5.



**Fig. 5.** Network networking and man-machine interaction design of pressure swing control for vacuum packing machine

In this paper, the hardware development and software design of the pressure swing control of vacuum packaging machine are realized [18, 19].

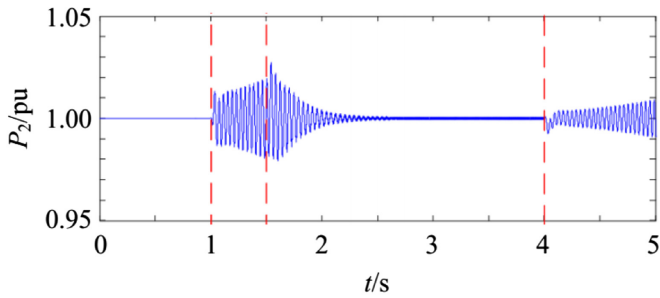
## 5 Experimental Test Analysis

The hardware test of vacuum packaging machine sealing transformer is carried out in 3D ICAD platform. Combined with embedded Linux program loading mode, the output bus control of vacuum packaging machine sealing voltage conversion control is carried out. The vacuum packaging machine sealing transformer is developed in Visual C++ software platform, the physical diagram of the vacuum packaging sealing machine is obtained as shown in Fig. 6.

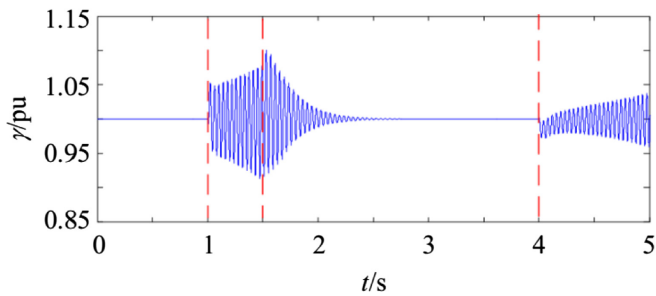


**Fig. 6.** Physical drawing of vacuum packaging and sealing machine

Using imported PLC programmable logic controller, computer touch screen operation, operating system fully sealed, the whole machine can be washed with clean water. That the designed vacuum packaging machine sealing transformer has good human-computer interaction. The cutoff frequency of vacuum packaging machine sealing voltage change control is tested, and the results are shown in Fig. 7.



(a) Output power



(b) Output voltage

**Fig. 7.** Cut-off frequency of pressure conversion control for vacuum packaging machine sealing

The analysis shows that the output cut-off frequency of the sealing transformer of the vacuum packaging machine is good, and the output stability is high.

## 6 Conclusions

The design method of sealing transformer of vacuum packaging machine is studied. The sealing transformer of vacuum packaging machine is established on the embedded control platform. The program control of sealing transformer of vacuum packaging machine is carried out by using embedded B/S framework method. The physical index acquisition module, integrated control module, network networking and human-computer interaction design of vacuum packaging machine sealing transformer are carried out. The output stability of the seal transformer of the vacuum packaging machine is good and the reliability of the system is high.

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