Design of electric control system for automatic vegetable bundling machine

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Abstract. A design can meet the requirements of automatic bale food structure and has the advantages of simple circuit, and the volume is easy to enhance the electric control system of machine carrying bunch of dishes and low cost. The bundle of vegetable machine should meet the sensor to detect and control, in order to meet the control requirements; binding force can be adjusted by the button to achieve; strapping speed also can be adjusted, by the keys to set; sensors and mechanical line connection, convenient operation; can be directly connected with the plug, the 220V power supply can be connected to a power source; if, can work, by the transmission signal sensor, MCU to control the motor, drive and control procedures for small motor. The working principle of LED control circuit and temperature control circuit is described. The design of electric control system of automatic dish machine.

1. Introduction
In this era of rapid development of science and technology, people like to use a wide range of scientific and technological products, those practical, convenient, easy to operate the machine has long entered our lives. Vegetables are essential food on the table, people only see the vegetable market on a bunch of vegetables to be placed neatly, but I do not know the farmers hard bound food. One common vegetable greenhouses, pick a greenhouse vegetables need only a few hours can all pick up, but the one or two day, a bundle of greenhouse vegetables that occupy a lot of time bound vegetable farmers. In the bundle of vegetables, vegetable farmers need to struggle to cook to tighten the bundle of good food, too exhausting, but people do not tie a small effort of good food, can only hire this bunch of dishes and cost increase. Therefore, the present technology urgently needs a new solution to solve this problem [1].

The utility model aims to solve the technical problem that the utility model provides a bundling machine, which is used for solving the technical problems of the prior art that the binding of vegetables is difficult and the food is slow [2].

In order to solve the above problems, bundle of dish machine provided by the utility model, which is characterized by comprising a convex wheel, driving wheel, wheel clamp, convex base, blade, hot head, motor, switch, power plug, shell, integrated circuit board, the convex wheel, the rotation of the cam and the driving wheel through the shaft clamp fixed in different motor; the motor is fixed in the internal plastic through screws; internal plastic fixed on the base through a hot melt adhesive; the blade and the head fixed in different internal plastic by glue, the two pieces of internal plastic bottom side have gear slot, with the two the gear and two motor shafts are connected by the gear on the gear meshing; The integrated circuit board fixed on the base and the internal plastic through glue; the
power plug and a power switch are arranged on the side wall of the outer housing, and a power plug and a power switch through the wire connected with the integrated circuit board [3].

2. The structure design of the automatic bundling machine

Through the analysis and reference of the existing food bundle design, this thesis designs a structure that can meet the requirements of the use of bundle vegetable machine has the advantages of simple circuit, simple control, volume is easily carried, low cost. The technical requirements to be satisfied by the bale machine: as shown in Figure 1 [4].

(1) sensor control;
(2) the binding force can be adjusted;
(3) adjustable speed;
(4) using circuit control;
(5) the work can be done by plug-in mode;
(6) small generator drive.

![Figure 1. overall mechanical structure](image)

1, convex wheel, 2, convex wheel clamp, the transmission wheel, the 4, the base, the 5, the blade, 6, hot melt head, 7, motor, 8, integrated circuit board, 9, internal plastic.

3. Design of electrical control system for automatic vegetable bundling machine

The main function of the bundling machine is to replace the hand to complete the action. In the process of using, it can be as long as the food rotation can, tape will automatically rotate a week, bunch of dishes of dish machine will bundle device and paper tape connection makes better bunch of dishes. Simple operation, the elastic bunch of dishes can also be fine tuned by binding force [5].

This bundle of vegetable machine structure design process is as follows: the action can be hot ribbon to send with the entrance, and then the sensor control board is an electrical device can clamp the paper tape rotating lead, then its rotation, the tape to seize a circle, then adjustable circular size according to the binding the size of the object to be; the dishes on the circle, this dish will touch the infrared sensor, the infrared sensor sends electrical signals, a belt feeding device will just send in tape again back at this time can control the force of bundling, strapping tension when appropriate, hot melt machine and cutting machine will work at the same time, hot melt machine the tape to melt together, cutting machine, tape cut, and finally removed bundle of good food. This will complete the entire process, less than a minute to complete the binding, fast. 220V AC power supply for bundling machine [6].

We can still use the chip in control. AT89C51 has its own characteristics, which are characterized by: low voltage, high performance, can be programmed with 4K bytes of Flash memory, but also with respect to stability. AT89C2051 is a built-in high-performance microcontroller with a 2K byte programmable EPROM. Single chip erasable read-only memory can be repeated 100 times. The device is manufactured using ATMEL's high-density nonvolatile memory technology production;
compatible with the standard MCS-51 instruction system; piece built-in 8 bit general purpose CPU and Flash; powerful AT89C2051 microcontroller can provide cost-effective in many applications for you, the device using ATML's high-density nonvolatile memory manufacturing manufacturing technology, compatible with the MCS-51 instruction set and output, industry standard. Due to the combination of a single chip multi-function 8 bit CPU and a flash memory, the ATML AT89C51 is an efficient microcontroller AT89C2051 which is a streamlined version of it. 89C SCM for many embedded control system provides a flexible high performance, low cost solutions. Shape and pin arrangement shown in Figure 2 [7].

![Figure 2. AT89C51 pin arrangement](image)

Pin description:
- VCC: supply voltage
- GND: grounding
- RST: reset input. When the oscillator reset device, the RST pin to maintain the high level of two machine cycles.
- ALE: when accessing external memory, the address latch allows the output level to be used to latch the status byte of the address.
  
  This pin is used to enter the program pulse during FLASH programming. In normal times, the ALE terminal outputs a positive pulse signal with a constant frequency, which is 1/6. of the oscillator so that it can be used against external output pulses or for timing purposes. Note, however, that one ALE pulse is skipped every time it is used as an external data store. If you want to prohibit the ALE output can be in SFR8EH address for 0 ALE at this point, only in the implementation of the MOVX MOVC instruction is s.s.t.i.s ALE. In addition, the pin is slightly elevated. If the microprocessor executes an external state ALE, the setting is not valid.
- PSEN: external program stores its strobe signal. During the fetch of the external program memory, two PSEN times per machine cycle. However, when accessing external data memory, the two valid PSEN signals will not appear.
- EA: when EA is low, then during the external program memory (0000H-FFFFH), whether or not there are internal program memory. Note that the encryption method 1, EA will be locked internally to RESET; when the EA side to maintain high power, the internal program memory. During FLASH programming, the pin is also used to apply the 12V programming power supply [8].
- XTAL1: input to the inverting oscillator amplifier and input to the internal clock operating circuit.
- XTAL2: output from the inverting oscillator.
3.1. Motor control circuit

We need to control 5 motors of the bundle of dish machine scheme, due to the pressing mechanism responsible for the food pressing task required torque and force, selection of power single-phase AC 1000W/AC220V drive motor, the longitudinal and transverse feeding and receiving belt drive motor, single-phase AC motor power 250W/AC220V cam drive motor. For motor positive and negative control circuit principle, as shown in Figure 3 [9].

![motor forward and reverse control circuit](image)

**Figure 3.** motor forward and reverse control circuit

In the drawing, the positive and negative control of the motor is realized by the control of K3 and K4's normally open normally closed contacts. The corresponding front control circuit is shown in Figure 4.

![motor control circuit](image)

**Figure 4.** motor control circuit

The relay is mainly used for isolation. Through the change of M2.0 and M2.1 level signal to control the turn-on and turn off of NPN transistor. Relay action to control the motor positive and negative. The M2.0 and M2.1 corresponding to the motor status are shown in the Table 1.

| M2.0 | M2.1 | Motor state |
|------|------|-------------|
| 0    | 0    | Stop it     |
| 0    | 0    | Stop it     |
| 0    | 1    | Reversal    |
| 1    | 0    | Forward     |
| 1    | 1    | Stop it     |
3.2. Heat sealing temperature control circuit
Fault control using a control signal control circuit of heat bundle of dish machine, three heating plates by using a parallel circuit with solid state relay SSR isolation. Circuit diagram as shown in Figure 5 [10].

![Figure 5. rhafu chip control circuit](image)

By CPU P3.2 control Q11 conduction which makes SSR work on the three sealing piece on-off control to control the temperature within a specified range. "SSR" is a symbol of a solid state relay, which is an electronic switch without mechanical shock.

4. Concluding remarks
To complete the control and design of the control system. Analysis signal, input and output signal, analog signal acquisition and processing, calculation, design. Signal circuit, sensor analog signal to measure the temperature, the introduction of LED control circuit, temperature control circuit, the main principle of each circuit. Finally, the design of electrical control system is completed.

The design is feasible, simplifying the rotating mechanism of the drive motor, reducing the design. The control scheme selects the 74LS245 chip of the computer chip by selecting the 8279 chip / 74LS373, etc., thereby controlling the improvement and simplification of the program. But also has the shortcoming, the bundling food is not very tight; in the control circuit, through the design input, the output, the scanning, the terminal quantity, the entire circuit level is not very good, gradually improves the manual temperature control function.

References
[1] Xudong Deng. Research and development of electrical control system for distributed control system [J], Hubei electric power system, Vol. 25 No.5, p.21.
[2] Shenghua Feng. 2009. A discussion on the development of electrical control of elevator [J]. science and technology information Vol. 21
[3] Liling Liu. 2011. The development technology of electrical control technology [J]. Journal of Beijing Electric Power College No.3, p.31.
[4] Guowei Zhu and Guoxiu Wang. 2003. Graphic LCD Module MGLS-19264. Application of Intelligent geophone[J]. Beijing Polytechnic College 2
[5] Changchu Liao. 2014. PLC programming and application (Mechanical Industry Press, China)
[6] Kewang Pang and Wenhua Yuan. 2014. PLC electrical control system design and application (China Electric Power Press, China)
[7] Zhiyong Jia, Xueying Li and Gao Hongyan. 2014. introduction to the application of PLC (China Electric Power Press, China)
[8] Huafeng Mei. 2015. electrical equipment and control (China Water Conservancy and Hydropower Press, China)
[9] Pin Wan and Dejie Lin. 2015. Electrical Testing Technology (Mechanical Industry Press, China)
[10] Songwei Huang and Jinhui Zou. 2015. electrical control and PLC application technology (Electronic Industry Press, China)