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Design of Greenhouse Vegetable Transplanter

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Abstract. The design is adopted by single chip microcomputer as the control side. The keys are used to control the stepping motor. Stepping motor that drives the transplanting mechanism to complete the automatic transplanting process of vegetables is controlled. The transplanting mechanism is equipped with photoelectric sensors and is capable of detecting whether the seeding is leaking. The operation efficiently sharply is improved by that method of transplanting mechanism.

1. Introduction

This paper uses seven parts liked power module, transplanting module, leaking detection module, 52 single chip microcomputer, LCD module, alarm module, and key module. The device is programmed in advance. The program is transmitted to the MCU by RS485. The user can set up the number of transplanting and the distance freely. The MCU controls stepping motor to transplant. When the seeds leakage in the process of transplanting, the photoelectric sensor that detected the signal will be transmitted to the MCU. And then, the buzzer sends out the alarm message and the indicator light all puts out to reminded user to make corresponding respond in time.

2. The whole design scheme

The vegetable transplanting block diagram is shown in the Fig.1. The project is designed based on the MCU controlled vegetable transplanted. The major component is as follows: the MCU control system, power module, transplanting mechanism, leaking detection module, key module, alarm and display module.



Fig. 1. Vegetable transplanting block diagram



3. Circuit design

3.1 Overall circuit design

The design adopts single chip microcomputer as the control side. Using the keys is to control the stepping motor. Stepping motor drives the transplanting mechanism to complete the automatic transplanting process of vegetables. STC89C52 is a micro controller which is high performance and low consumption, it's manufactured by CMOS. Its standard features are as follows.

STC89C52 has 8k bytes of ROM and 256 bytes of RAM. Four 8 run side by side I/O interface P0 four P3. Two 16 bit timer /counter. Five cutting off sources and two prior interrupt structures. One all duplex serial I/O mouth of UART. Stretch oscillator and clock produce circuit. The show is in the Fig.2.



Fig. 2. STC89C52 minimum system circuit diagram

3.2 Design of the detection circuit of photoelectric sensor

In order to detect the phenomenon of leakage, we need to set up a sensor on where the seeds are transmitted so that we can know whether there is a leak or not. We use the sensor called E18-D80NK. The wiring diagram is shown in Fig. 3.



Fig. 3. The wiring diagram

3.3 Design of power circuit

The design is powered by an extra 220V and 50HZ AC power. However, the work voltage is DC 5V. We need to transform the extra power so that the whole work system works. The 220V changed to 5V is shown in Fig. 4. The 220V changed to 15V is shown in Figure 5. It is advisable to keep all the given values.



Fig. 4. 5V DC power circuit diagram





Fig. 5. 15V DC power circuit diagram

3.4 Design of stepping motor power circuit

Stepping motor can't link to DC or AC directly, which must use dedicated drive power (step motor drive). The controller (pulse signal generator) can control the angular displacement by controlling the number of pulse, to achieve the goal of positioning accurately. At the same time, we can control the frequency of pulse to control the motor's rotational acceleration and velocity. Thus, the purpose of speed regulation is achieved.

2DM2280 is a professional two-phase stepping motor drive and can realize positive and reverse control. Through three dial code switch selects seven subdivision control and eight current control. 2DM2280 is suitable for 110 and 130 types two-phase or four-phase mixed type stepping motor. The diagram of driving and wiring is shown in Fig. 6.



Fig. 6. Stepping motor drive circuit diagram

3.5 Design of key circuit

The structure of the device consists of the bearing support, folded plate, the connecting rod and the guide blade tube. When you start transplanting, the stepping motor drives the connecting rod.

The connecting rod drives the guide blade tube, picking up the seeds and finishing other work. Users control the rotational angle by pushing the key, and control the distance between plants and transplanting times. The structure of devices is shown in Fig. 7.



Fig. 7: The structure of the device

4. Design of the software

The software design of the system mainly includes the design of the photoelectric sensor, and the design of the key module, the design of the display module. In the control, we control the rotional angle by adjusting the angle of the motor turns to control the position of the guide blade plate. The main program flow chart is shown in Fig. 8.





Fig. 8. Main program flow chart

5. Conclusion

Automatic greenhouse vegetable transplanted is very important for liberating productivity and developing intelligent agriculture. This system is mainly designed for agricultural greenhouse vegetable transplanted. The program has been programmed in advance. The program is downloaded to the MCU through RS485 communication. The user can set the transplanting number and Transplanting spacing freely, and single chip microcomputer controls stepper motor 130J18278 start to transplants. When there is seedling leakage during transplanting, once the signal is detected by the photoelectric sensor E18-D80NK, the signal will be sent to the single chip microcomputer. The buzzer sends out the alarm information, indicating that the lamp is completely extinguishing to remind the user to respond to the corresponding measures in time to reduce the rate of leakage and improve the production efficiency. From the result, by applying the application knowledge of stepper motor and single chip microcomputer, the system can transplant most vegetable crops. But in agricultural production, different soil hardness and long time work will cause different interference and influence to the system. Therefore, the system also needs to be improved, followed by the fan for the motor heat dissipation, the duck's mouth is added to the humidifier, join the seedling leakage response mechanism, self replenish seedlings, join the wireless communication monitoring facilities, remind people in case of abnormalities, truly achieve automatic vegetable transplanting.

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