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Design of greenhouse ecological box

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Abstract:

The focus of this research is to design and manufacture a transparent greenhouse ecological box, provide controllable light source for plant planting, adjust temperature and humidity, and provide farmers with a new cultivation energy to create a more sophisticated plant industry.

Keywords

Greenhouse system, humidity, prototype

1. Introduction

Because we live in Taiwan with an island-type climate, the weather is usually humid, so some tropical plants cannot survive on our island. In order to allow these plants to survive on our island, we have made ingenuity to make the tropics. [1] The eco-box for the survival of cold-type plants allows us to see other climate plants in Taiwan.

In this modern and busy society, because time is not enough to take care of plants, we want to make a fully automatic and beautiful greenhouse eco-box [2] that is both time-saving and labor-saving, and is related to the courses we have studied. I hope that it can be successful and make the perfect work.

2. Circuit elements

2.1. Introduction to CD4069 principle

The output voltage of the circuit varies greatly with the output current. It is only suitable for the supply of low-power components (such as small LCD panels, low-power operational amplifiers, etc.). The conversion efficiency is only within 22%, but due to The circuit cost is quite low, and the output current can be accurately controlled in the application to maintain the output reverse voltage to a certain level. IC4069 pin map is shown in Fig.1.

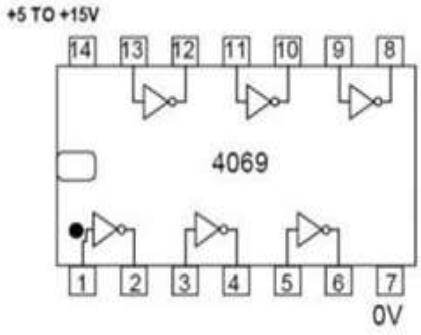

Fig.1 IC4069 pin map

2.2 CD4069 internal structure

About IC 4069, there are 6 CMOS inverters, which use two inverters and two resistors (R1, R2) and one capacitor (C1) to form an oscillating circuit, leaving 4 inverting circuits. Used as a buffer to increase the supply current. Four diodes (D1~D4) and four filter capacitors (C2~C5) form a voltage double rectifier circuit to provide conversion voltage output.

2.3 Introduction to LM7805

The lm78/lm79 series three-terminal regulator IC is used to form a regulated power supply with few peripheral components. The circuit also has overcurrent, overheat and regulation tube protection circuits, which are reliable, convenient and inexpensive. The digits behind the lm78 or lm79 in this series of integrated regulator IC models represent the output voltage of the three-terminal integrated regulator circuit. For example, lm7806 indicates that the output voltage is positive 6V, and lm7909 indicates that the output voltage is negative 9V.

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Because the three-terminal fixed integrated voltage regulator circuit is convenient to use, it is often used in electronic production.

In practical applications, a sufficiently large heat sink should be installed on the three-terminal integrated voltage regulator circuit (of course, under low power conditions). When the temperature of the Zener tube is too high, the voltage regulation performance will be deteriorated or even damaged. When a constant voltage power supply capable of outputting more than 1.5A is required in the production, several three-terminal voltage regulator circuits are usually connected in parallel to make the maximum output current of N 1.5A, but the application should pay attention to the integration of the parallel use. The voltage circuit should use the same manufacturer and the same batch of products to ensure the same parameters. In addition, there is a certain margin on the output current to avoid the chain burnout of other circuits when the individual integrated voltage regulator circuit fails.

The most commonly used in the lm78 **, lm79 ** series of three-terminal regulators are the TO-220 and TO-202 packages. The correct order of the 7805 pins are 1 pin input, 2 pin ground, 3 pin output, respectively. 7805 regulator IC pin diagram is shown in Fig.2.

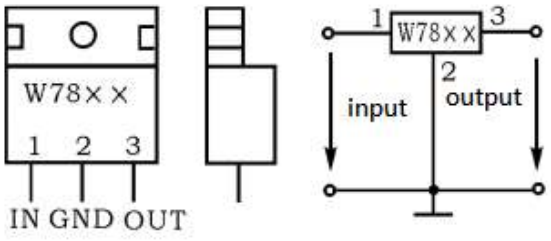

Fig.2 7805 regulator IC pin diagram

3. Circuit design

As shown in Figure 3, the iron is used to detect the humidity in the aquarium when the sensor detects the humidity in the aquarium. When the humidity is lower or higher than the threshold, the sprinkler system is activated, and the LED lighting is used to achieve the photosynthesis of the plant, and the rechargeable battery is used to provide the ecology. The backup energy required for the box in the event of a power outage.

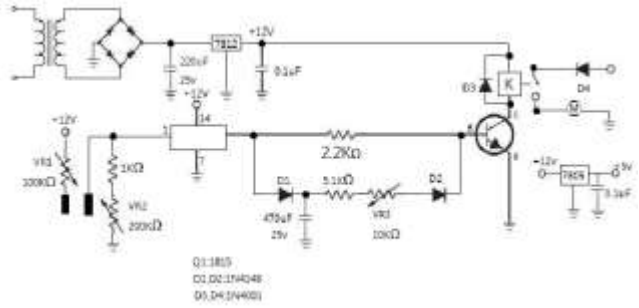

Fig.3 circuit design of greenhouse ecological box

Regardless of half-wave or full-wave rectification, although the output voltage is in the form of direct current, it is not a good direct current, but a periodic "pulsating direct current" whose pulsating component is called "ripple". Most electronic components do not want to operate at a pulsating operating voltage, so we must try to reduce the ripple of the output to supply a smooth DC voltage.

When energized, Vin not only passes through the diode D, but also charges the capacitor C. When the capacitor is charged to the maximum value Em, the voltage begins to drop and discharges the load RL. The power of the load RL is supplied by the capacitor C, and Looping to the next cycle, the larger the capacity of the capacitor, the more charge that can be stored, and the lower the voltage drop during discharge. Conversely, if a smaller capacitor is selected, the voltage drops more, so the capacitor plays an important role in the filtering effect. character of. How big is the capacitor? We must also consider the current that the load can tolerate. According to the circuit formula of circuit electronics, we know that the charge Q stored in the capacitor is related to the voltage V across the capacitor and the size C of the capacitor.

We made a "regulated DC power supply". The voltage output pattern of the production process

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and each step is shown in Figure 4. The sub-items are as follows:

(1) Select the appropriate transformer according to actual needs and step down the 110V AC power supply.

(2) Full-wave rectification using a bridge rectifier to convert the AC voltage to a DC voltage.

(3) Select a capacitor of the appropriate size for filtering.

(4) Adjust the input voltage to the required precision voltage with a voltage regulator IC.

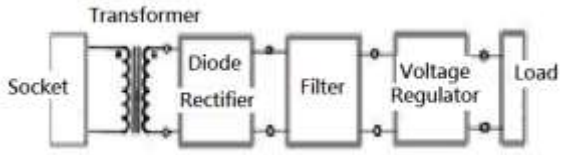

Fig.4 Block diagram of the power supply and the voltage output at each step

The circuit of the above manufacturing process is shown in FIG. 5. Our self-made "Stabilized DC Power Supply" uses three transformers, 9V, 15V, and 24V, which can supply five sets of commonly used stable DC voltages, which are 5V, 9V, 12V, 15V, and 24V. Among them, 9V transformers are used for 5V and 9V, 15V transformers are used for 12V and 15V, and 24V transformers are used for 24V. The five sets of voltage configuration are shown in Figure 5.

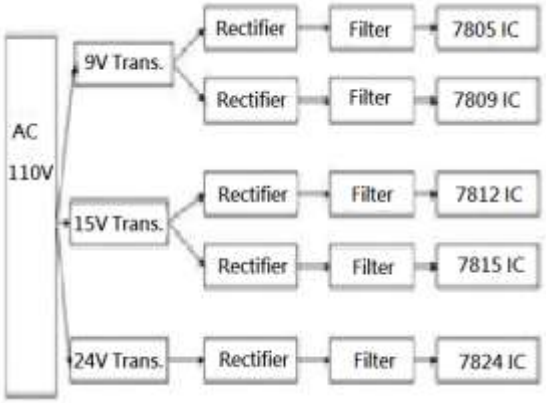

Fig.5 Power configuration

Hardware circuit primary completion diagram is also shown in Fig.6.

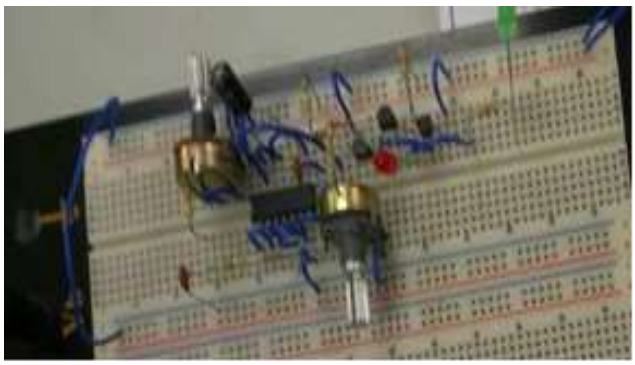

Fig.6 Primary hardware circuit completion diagram including circuit elements

4. Results and discussion

Figures 7 to 11 show the finished product map for this article. In the future, the agricultural environment will gradually develop towards the “smart greenhouse”. The greenhouse eco-box made by us is providing a reference.

Fig.7 Hardware circuit completion diagram on board

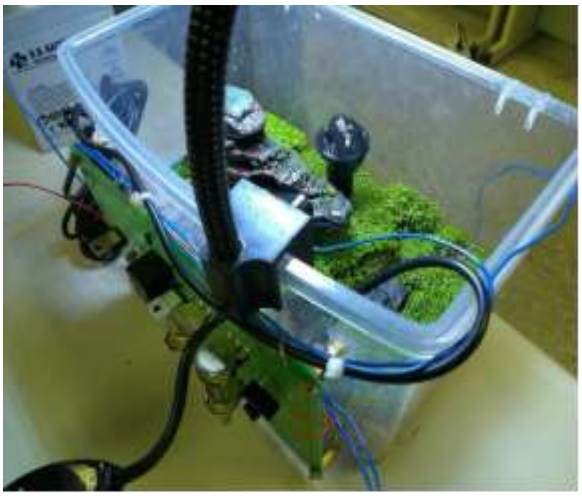

Fig.8 Hardware results left rear view

Fig.9 Hardware results top view

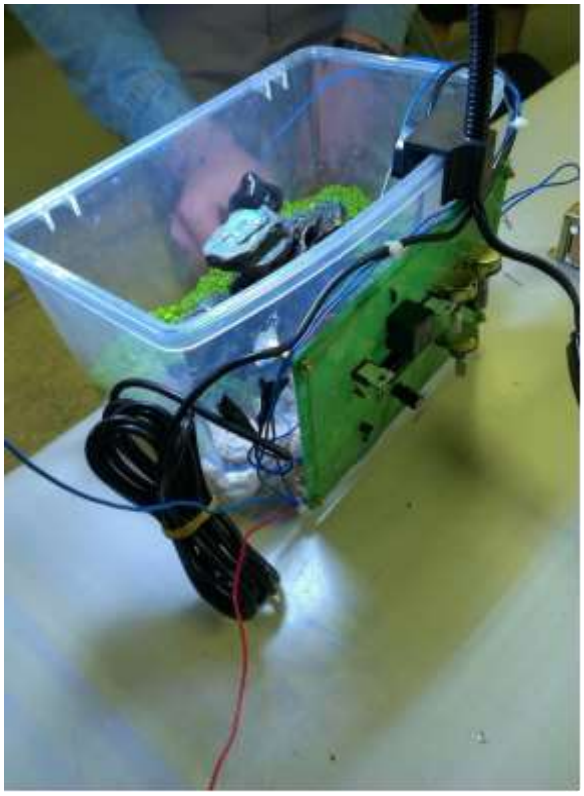

Fig.10 Hardware result right rear view

Fig.11 Hardware production process test chart

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5. Conclusions

We have successfully implemented a simple greenhouse eco-box with hardware circuits, and with this preliminary result, there will be potential for application and development of a larger system.

6. References

[1] Zhao Xiaoyan et al, "The design and implementation of the greenhouse monitoring system based on GSM and RF technologies", 2013 International Conference on Computational Problem-Solving (ICCP)

[2] Thangavel Bhuvaneswari et al, "Automated greenhouse", 2014 IEEE International Symposium on Robotics and Manufacturing Automation (ROMA)