Greenhouse Environment System Based on Remote Control


Abstract—The proposed paper is about remote monitoring greenhouse environment system by the smart mobile. We establish a system to control greenhouse environment through the smart mobile or PDA. National Instrument's (NI) FieldPoints are applied to retrieve the environment parameters on real time in the greenhouse. Environment parameters are transmitted to a PC server after data processing. Users can use smart mobile or PDA to control and monitor the system in anywhere by the wireless network. Phalaenopsis are high-priced products in Taiwan, so we chose the orchid as our sample to build a greenhouse environment system. The result shows that the designed system could be more effective in manpower savings and raising the economic value of products.

Keywords—FieldPoint, greenhouse, Phalaenopsis, smart mobile

I. INTRODUCTION

During the past decades, industry was flourishing and it resulted in massive emissions of carbon dioxide. The probability of extreme climate occurring is increasing. The extreme climate will lead to the lower output of agricultural production. In this situation, people created a greenhouse. And Taiwan has the extreme climate. So greenhouse is very suitable for Taiwan. On the agricultural output, greenhouse has much than non-greenhouse. In this study, we utilize Field Point of National Instrument to build the greenhouse environment control system, which is shown in Fig. 1. And we used LabVIEW as programing language to compiling. Field Point can control several arguments of greenhouse, and which can monitor in long time. We can use smart mobile to control the PC server through the wireless network. And Field Point will adjust environment of greenhouse through controlling the device. User can master the status of the greenhouse through web cam, and which use the smart mobile to control greenhouse environment system on anywhere. Above said the propose system can to economize the use of manpower.

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II. PURPOSE AND APPROACH

The purpose of this research wants be more effective in raising the economic value of products. Phalaenopsis spp. belongs to tropical or subtropical orchid plant with beautiful flowers, and its florescence is very long [1]. It is earlier for tissue culture of orchid at abroad. It is reported that the intact plant was developed from dormant buds of flower stalks under sterile conditions in 1949, and this method has become the main pathway for Phalaenopsis propagation for some time[2].So we took the Phalaenopsis as our example. We want to let orchid can better by the greenhouse environment control system. And user will don't need to take care of orchids on the bad weather, which is shown in Fig.2

By the way, this system took inter face of LabVIEW. Not only it can save time in compiling program and test of sensor, but also can let user begins easily.

III. HARDWARE ARCHITECTURE

A. Sensor signal capture

Sensor signals have many temperature sensor, humidity sensor, PH sensor, CO2 sensor and light sensor. And we took...
several sensors to link the multiplexer. DOChannel of FieldPoint DO-400 chose a sensor through controlling multiplexer. And AIChannel0 of FieldPoint AI-100 was receiving signal from multiplexer. Finally, the signal sends to the web server through RJ-45[3], and the signal display to LabVIEW interview, which is shown in Fig. 3.

B. Temperature of soil and humidity of soil

Temperature and humidity is one of growing factors for the plants. In the propose system, we used temperature and humidity sensor, which is call EE10-FT. The detection range of temperature sensor is -5~+55°C [4]. And the detection range of humidity sensor is 0~95 %RH. When the temperature rises to 35°C on the summer, Phalaenopsis will stop growth. So system will switch on the air conditioning. When temperature dropped abruptly to 10°C, then system will switch on the Heater. Temperature control flow which shown in Fig. 4.

Water is important for the Phalaenopsis. If the humidity is too high, then the root of a Phalaenopsis will be spoiled by soaking. And if the humidity is too low, then Phalaenopsis will wither. So when the humidity is too high, the system will switch on the circulation fan. On the other way round, when the humidity is too low, the system will start to spray water. The humidity control flow is shown in Fig. 5.

C. CO2 sensor

In this research, we choose CO2 sensor, which called EE-5C3. The detection range of EE-5C3 is 0~5000ppm. When concentration of CO2 is too high, then the proposed system will switch on circulation fan. Let Phalaenopsis have best growth environment [5].

D. Light sensor

We use light sensor, which called S1133. Phalaenopsis needs light less than the orchid in general, so it cannot grow well under direct light. Phalaenopsis suited the band of light is 300~700nm, and this band can be photosynthesis, which shown in Fig. 6.

In this study, we design the LED lighting system through solar battery. The traditional light bulb can heat generation. So we used LED lighting system don’t worry which have overheating in using traditional light bulbs. And it can conserve power. In the visible spectrum [6], the absorption of light rays is blue (400nm) for the Phalaenopsis. And the second is red light (670~700nm). The LED lighting system can control LED wavelength to this band for Phalaenopsis photosynthesis [7]. The lighting control flow is shown in Fig. 7.
E. PH of soil

We use pH of soil sensors called IQ150 direct soil pH meter, which has been shown in Fig. 8. When the reader of pH meter of soil dropped below the range, this system will display a warning signal to man-machine interface through FieldPoint AI-100 which captures signal and inform users by GPRS. Fig. 9 shows the designed transceiver circuit of pH meter.

A. Voice warning
Voice warning system can get notice of condition through voice.

B. Data list
The several signals will save to Excel through Report Generation Toolkit. The Report Generation Toolkit is product of NI. This data is very important for users. If machine breaks down, users can check it through data list, which has been shown in Fig.11.

C. Remote monitor
User can use smart mobile or PDA to link the system by the wireless network. And it can control and monitored the condition of greenhouse through remote control [10]. User don’t need monitor on the computer at long time. The front-panel of PC server has been shown in Fig. 12.

D. Camera monitor
Not only user can use a smart mobile phone or PDA to monitor the condition of greenhouse, but also can watch greenhouse by the web camera when greenhouse has any questions [11]. Fig.13 shows the front-panel view of web camera.
V. SYSTEM IMPLEMENTATION

The proposed system has been implemented by using NI’s LabVIEW 2010 as programming language. The friendly front panel of PC server has been shown in Fig. 14. This is quite efficient in observing and manipulating. The major growth conditions of Phalaenopsis are all included, e.g. Temperature, pH of soil, light condition, CO₂ etc. The corresponding sensors are all installed. Each function is tested and the system performs well. The complete architecture of hardware design of system has been shown in Fig. 15.

VI. CONCLUSION

In this research, we establish a greenhouse environment control system which is similar to greenhouse control system developed in Israel. But our design is more efficient which can adjust greenhouse environment in anywhere by a smart mobile. And this function will let user grasp the information as soon as possible. In addition, we use Report Generation Toolkit to record the data of greenhouse. It could let the researchers understand the best orchid growth conditions, and grasp it.

Furthermore, we use solar cells and LEDs to establish a smart lighting system. Even if raining, the smart lighting system will supply enough light for the greenhouse environment. The result shows the proposed system is effective and feasible. This system saves human resources, power and water consumption a lot. But if this system will be applied to the other farm produces, then we will need to add more environment factors.

REFERENCES