Design of Answer-Grabbing Devices Based on Labview

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Abstract. Answer-grabbing devices are widely used in various TV programs, competitions and other fields. At present, with the increasing demand for fairness in competition, higher requirements have been put forward for answer-grabbing devices, such as higher sensitivity, better reliability, more powerful functions and so on. To meet this requirement, this paper designs a answer-grabbing devices based on Labview, which consists of answer-grabbing module, display module, compere button module and control module. Through design of front panel and program, debugging and operation, the functions of answer-grabbing device, as timing, scoring and zero clearing are finally realized. Experiments show that the system has high reliability, sensitivity and multiple functions.

1. Introduction
Nowadays, with the diversification of information, various contests begin to appear in the shows. As knowledge contests, Lyric guessing contests, etc. In these contests, competitors are often required to compete for the right to answer questions. The general method is that after the compere reads the questions, he will send out the signal to start answering, and then the competitor who responds to the signal fastest will get the right to answer questions, if only by relying on the compere's on-site judgment, it is easy to cause misjudgment, so human beings invented the answer-grabbing devices. The answer-grabbing devices should be stable, accurate and interactive in order to improve the overall level and ornamentation of the competition.
At present, all the answer-grabbing devices on the market are equipped with physical equipment, which is difficult to install and debug, expensive and unstable. In order to solve the above problems, this paper designed and developed a new type of answer-grabbing devices with the technology of virtual instrument.

2. System design
The system consists of answer-grabbing button, start button, control center, display for score, display for time, timer, pilot lamp and setting device. We can set the time of answering questions by setting device. The system starts to run after the compere presses the start button. When a competitor presses the answer first button, the corresponding pilot lamp turns green. At this time, the competitor enters the Q & A session. And the other competitors can't answer any more, then the timer starts to run and display time. The first competitor can answer the question before the end of the time. The compere judges whether the competitor's answer correctly or incorrectly, press the True button or False button.
to add or subtract points. If the competitor grabs the right to answer questions, but he does not answer within the time limit, the corresponding pilot lamp turns red.
The system chart is shown in Figure 1.

![System Chart](image)

**Figure 1. System Chart**

This scheme has many functions, such as answering, timing, scoring, zero clearing, and so on. Because it does not involve latches and decoders, the system is relatively simple and has good stability.

3. **Front panel design of the system**

The front panel design of the system is divided into five modules, namely the answer-grabbing button module, the display for score module, the compere button module, the pilot lamp module and the answer time module.

According to the number of participants, the number of answer-grabbing buttons is different. In this program, the answer-grabbing buttons are selected from the front panel-control-Boolean-confirmation button. This design adopts the scheme of four keys, which can help four competitors to race at the same time, and reserve space for expanding into multi-channels answer-grabbing devices.

Labview provides a variety of display modules, it is simple to call and intuitive to display. Considering the intuitive requirement of the score display in this design, the numerical direct display scheme is adopted. The numeric display is selected from the front panel - control - numeric - numeric display control, and each competitor corresponds to a numeric display.

By consulting the information, the compere buttons should include start button, correct button, error button, zero-setting button, and each button is selected from the front panel-control-Boolean-confirmation button. Among them, the start button is used to start the whole system. After the start of the system, the following functions such as timing, answering and scoring can be performed. And only when the start button is pressed, the competitor's answer-grabbing button can be pressed, otherwise, the answering is invalid. In other words, when answering in advance, there is no response when the button is pressed. After the competitor race to be the first to answer a question successfully and answer questions, the compere judges the correctness and error of the answers. If the answer is correct, the compere presses the correct button, and the competitor gains points; if the answer is incorrect, the compere presses the incorrect button, and the competitor loses points (or no points). At the end of a round of game, the zero-setting button is used to clear the scores, timing and initialize the current status of the answer-grabbing buttons and the pilot lamps in the round. The exit button is used to finish and exit the program.

The pilot lamps have two display states: red light and green light, (red light means answering time-out, green light means racing to be the first to answer a question successfully), each pilot lamp is selected from the front panel-control-Boolean-circular indicator light. The system consists of four pilot lamps. Answer time module includes answer time limit device and answer time display. Display control is selected from front panel - control - numeric - numeric input control.
Answer time limit device is used to set the time limit for a competitor to answer questions. If the answer is timeout, the corresponding red light in front of the competitor lights up. Answer time display is used to display the time spent by competitor. It is realized by front panel-control-numerical-numerical display control.

The front panel of the answer-grabbing devices is designed as shown in Figure 2.

![Figure 2. Figure with front panel of answer-grabbing devices](image)

4. Program panel design of the system

This design first initializes the program, then enters the key detection, and when it detects that the start button is pressed, it will start to answer. Detection status of the four competitors' answer-grabbing buttons and the compere's zero-setting button. If a competitor press the answer-grabbing button, he will start to answer question. If the zero-setting button is pressed, the time and score will be cleared, this round of game will finish.

The system flowchart is shown in Figure 3, and the program of the system is shown in Figure 4.

![Figure 3. System flowchart](image)
5. Debugging and Operation

After the front panel and program design of the system are finished, it can enter the debugging stage. The specific debugging operation is shown below.

5.1. Operating state I

Under normal working conditions, a competitor raced to be the first to answer a question successful after the compere pressed the start button, and answered correctly within a limited time, the compere should press the correct button to add 10 points to the competitor, as shown in Figure 5.

5.2. Operating state II

The competitor raced to be the first to answer a question successful after the compere pressed the start button, but answered incorrectly, the compere should press the incorrect button, the corresponding pilot lamp turns red, as shown in Figure 6.

5.3. Operating state III

After a round of fierce response, the compere is responsible for recording the data, resetting and initializing the system, as shown in Figure 7.

![Figure 4. Program of the system](image)

![Figure 5. Normal working state of the system](image)

![Figure 6. Timeout state of the system](image)

![Figure 7. Reset state of the system](image)
6. Conclusion
Aiming at the demand of current market, we designs a answer-grabbing devices based-on Labview, which has the functions of answering, timing display, scoring display and compere control on-site, it can meet the requirements in most environments.
In the later stage, we will continue to work hard to add the hardware to be a part of the system, it will make the system more perfect.

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