

# Research on the Computer Aided Evaluation of Physical Exercise

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**Abstract.** Heart rate telemetry with its software design is built on the Windows operating system platforms currently widespread use of microcomputers. It can be achieved that using a computer to automatically collect heart rate, analysis and processing the automatic assessment of exercise load. It can also improve the analysis efficiency evaluation of student movement load in physical education class. It has high practicability and popularization.

## 1 Introduction

Traditionally, the evaluation of physical exercise to the physiological evaluation mainly relies on artificial heart rate collection, and then we draw the heart rate curve in the coordinate paper, calculate the motion load index artificially as well. This method is lack of accuracy and low efficiency. The XLY-1 telemetry heart rate meter created by the state development realizes heart rate acquisition receiving work, ceasing the history of simply utilizing artificial pulse measurement. But after the heart rate acquisition, we still need to draw the heart rate curve on the coordinate paper personally, and calculate the exercise load index. Obviously the instrument does not fully realize the automatic evaluation on physical exercise. Therefore, on the basis of investigation, our research group members put forward with a development assignment --"the use of computer aided assessment research task of sports load"—to achieve the automatic evaluation of exercise load and improve the moving load speed and accuracy of the comprehensive assessment. The task group carried out scientific design and rigorous proof on the technological problems, put forward the project report, and obtained the research project in Henan province Science and Technology Commission. Thanks to the efforts of all the members in this research group over a year, it has been finished and gone through the identification check. Now we presented it in written forms for everyone to discuss.

## 2 The Research of the System

### 2.1 The design of the system

According to the development task and objective, through the design and demonstration, the research group decided to conduct secondary development based on the XLY-1 type telemetric instrument and the formation of the technical proposal as follows: the acquisition, transmitting and receiving wireless signal of heart rate can be achieved on hardware. After conversion to achieve automatic storage of A/D signal[1], we can realize the Unicom of the computer and pulse recorder through the connection of computer parallel port. Heart rate curve of the whole class and automatic evaluation of exercise load can be displayed in software.

### 2.2 The realization of the system

2.2.1 The front part includes heart rate collection, launch, FM receiver demodulation for the new development production of ALY - type 1 telemeter heart rate test system.

### 2.2.2 Connect the computer and pulse recorder

In order to realize automatic computer heart rate analysis and assessment of exercise intensity,

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we must implement the heart beat recording device to the computer to send and receive data, it involves the key technology of microcomputer hardware and software two aspects, which is one of the technical difficulties of this system.

The external interface of recording equipment is used in the standard parallel output port, while the microcomputer isn't usually used for parallel interface for data input, therefore, we cannot achieve the normal transmission of data. In order to solve the problem[2], we deal with the parallel port from two aspects of hardware and software, namely redefine the parallel port pin signal, and write a program of the data input device drivers for the parallel port. With the parallel interface VXD communication, we can implement the data of normal transmission.

#### (1) The pin definition

① Redefine the parallel interface pin signal: In order to make the parallel port become the input port, the parallel signals should be redefined, defined as follows:

The pin definition

mainframe parallel print port		microcomputer parallel print port	
the original name of signal	the original signal line	the new signal line	the new name of signal
/STROBE	1	10	10
DATA	2-9	2-9	/ACK
/ACK	10	1	1 /STROBE
BUSY	11	14	/AUTO FEEDXT
PAPER END	12 Earthing		
SLCT	13 Vacant		
/AUTO FEEDXT	14	11	11 BUS
/ERROR	15	17	17 ELECT IN
/SLCT IN	17	15	/ERROR

#### ②The main pin function:

**/STROBE:** Strobe, low level effectively, pulse width should be greater than 0.5 microseconds. Its function is to send data to a printer interface.

**DATA:** 8 data lines, three state bidirectional data bus, used for data transfer.

**/ACK:** Response signal, low level effectively, said the printer has received data.

**BUSY:** Busy signal, high effective, said printer can not accept new data.

**PAPEREND:** Paper out signal, high effective, said the printer out of paper.

**/ERROR:** An error signal, active low, said printer error.

#### (2) The virtual device driver:

Because Windows is a multitasking operating system environment, on Windows system platform, the application cannot directly to hardware devices to read and write. Otherwise, it's easy to cause conflict and even lead to system collapse[3].

On the platform of Windows system, in order to have reliable drive hardware, you must write the corresponding driver equipment. Windows hardware platform on the driver is called virtual device driver, VXD. Virtual device driver (VXD) is a program running in the kernel level Windows 9X operating system. It's based on the IINTEL80X86 series (including the PENTIUM Series) microprocessor (MPU), the ring0 privilege level VXD running on the microprocessor (the highest privilege level), and it's the part of the operating system which can be trusted. For the standard equipment of the microcomputer, the device driver program is provided by the equipment manufacturer driver; for non-standard hardware equipment, such as the self-developed hardware equipments need to develop the corresponding hardware device driver[4].

In this system, in order to improve efficiency and implement a large amount of data transmission, we use the method of interrupt driven when the computer collect heart rate data. In order to ensure the stability of data acquisition and the reliability of the system, the system of computer data acquisition part uses the device driver programming, namely we wrote a interrupt driven device driver for the data acquisition, which is a Windows9X virtual device driver (VXD).

Developing a virtual device driver needs some special tools, such as DDK, macro assembler and Visual C++ which are produced by Microsoft Company. This system uses VXD generation tool

VTOLSD produced by the Numeral company and Microsoft's Visual C++6.0 as the development tool. The VTOLSD generates the framework of VXD, and then we can complete the VXD coding by using Visual C++6.0. Finally, we can generate device driver with the use of Visual C++6.0. This is the virtual equipment drive program that we need.

The system uses WINDOWS95/98 unique VXD technology on WINDOWS95/98 microcomputer. It can ensure the reliable transmission of data.

#### 2.2.3 Computer analysis and processing:

Under the control of applications, the microcomputer can input the staging of the heart rate data that is stored in the heart rate recording device into another microcomputer through a standard parallel port of the computer. Then the microcomputer can make the rhythm analysis automatically according to the heart rate data collection, including error detection data filtering, heart rate curve drawing shows the various stages of the mean heart rate, exercise intensity exercise load index and evaluation[5].

Application features are: first, through the virtual device driver with driving parallel interface VXD communication, we can get the heart rate data. We can draw and display the corresponding heart rate curve according to the heart rate data. Secondly according to the received heart rate data, we can calculate the stages (including stage, preparation activities, classroom before class, after class recovery phase, etc. of the average heart rate), calculate the exercise load index, exercise load evaluation system (see Annex 3) and choose the size of the physical education sports load.

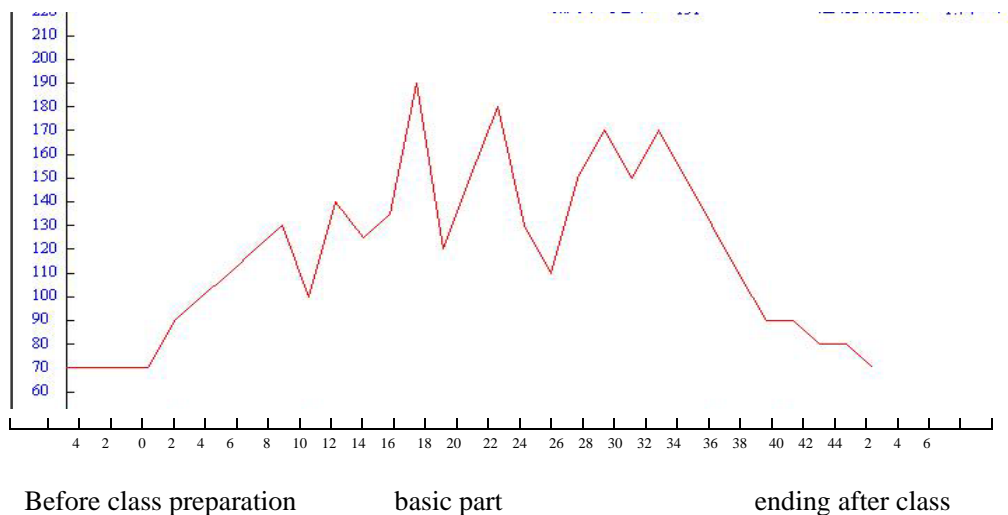
Developing applications uses Microsoft Company's Visual C++ 6. The application process is in Appendix Two.

### 3 The Test Conditions About The Use of the System

#### 3.1 The actual use of the testing

In May, we do an actual measurement in the Kaifeng University. The course content is the quality of circulating practice and basketball teaching match. The time is 45 minutes and the teacher is Chen Hong. The measured object is Wang Yier (medium level students recommended by the commissary in charge of sports.) In accordance with the requirements, the sensor is placed on the right chest of the body. It can collect the heart rate. The information that reflects the human body heart rate will be transmitted by radio waves. Then we should tun FM radio until we can hear the sound of the heart clearly. We can get the heart rate data after demodulating FM signals. After receiving the singals, they can be temporarily stored in the buffer. At this time we should connect the computer and pulse recorder well with connecting cable. We can put CD into the CD-ROM, double click "my computer", and then double-click CD-ROM icon. We can see all the files on the disc. Double click on the "SETUP.EXE" file and start the software installation (the password isCHBZ). When we click "automatic analysis of moving load", the main program interface will appear, and at this time the computer is in standby state. Then we transmit the cached data stored in the pulse recorder to the computer. The computer can draw heart rate curve automaticlly after analysis and processing. It can caculate different kinds of average heart rate and it can evaluate students exercise intensity, and then the computers automatically display the above information, as well as the students basic information.

As shown in the figure below:



### 3.2 Analysis of test results

#### 3.2.1 The heart rate curve is scientific and reasonable.

From heart rate curve we can visually see the process of sports load from low to high, then from high to low again. The process is consistent with the rule of the physiological function of human body activity.

#### 3.2.2 Exercise load is appropriate.

The average heart rate is 132 beats / min for the whole class. Exercise load index is 1.7. The students' physiological load in this class is close to medium after checking the motion evaluation form. The high peak time is at the time of the twentieth minute, the first half part of the whole course, which belongs to the peak of partial anterior type. So under this kind of condition it has less influence to the next cultural courses.

## 4 Conclusions

In summary, the successful development of the software design of automatic evaluation and exercise load solves the evaluation of history teaching evaluation in measurement artificially and fills the blank of microcomputer review physical exercise, which is of great significance to the scientific and correct evaluation of exercise load.

## References

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