A SYNCHRONISED CONTROLING, DATA COLLECTING AND PROCESSING SYSTEM USED IN BIOMECHANICAL MEASUREMENTS

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This paper introduces a microcomputer system which realized the synchronized controlling, data collecting and processing of several instruments or measuring system. According to different purpose, it can be used for the synchronized operation of film cameras, video cameras, force platforms, EMG, EEG and pulse measurement. The central control and process part is a microcomputer. It synchronically controls other instruments and the data collecting by A/D, D/A converter and synchronizer. It can be widely used in sports biomechanics research and teaching.

1. HARDWARE

The system is composed of a IBM PC/XT microcomputer (PC, or PC/286 etc.), high speed A/D, D/A card, synchronizer, sampling and analyzing software package, several KISTLER force platforms and charge amplifiers (see below).
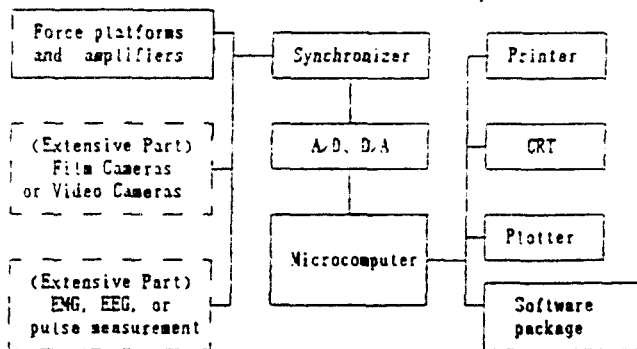

Figure 1: The frame graph of system

2. SOFTWARE

The software package which we made is composed of several programs:

1/ Data collecting, processing and analysis program.

2/ Fast feed back measuring result of platforms program (display in English or Chinese).

3/ Continuous check fixing platform(s) program (display in English or Chinese).

4/ Check Data-Collection System program.

5/ Check computer CPU frequency (speed).

6/ Program of designing measurement experiment and enlarging the effective measuring area of force platform.

3. MAIN FUNCTIONS OF SYSTEM

The system has following functions:

1/ Several instruments (such as,high speed film camera(s), video camera(s), force plarform(s) and its amplifier(s) EMG, EEG, and other maesuring systems can be synchronized by synchronizer which can provide two sets of synchronized signals, one is ready-signals, the other is data-collecting-signals.

2/ Several force platforms can be used comprehensively. In serial condition, several force platforms can be used as a large one and placed in any form. In parallel condition, the data synchronically collected from different platforms can be processed separately.

3/ The system software can be used to design to enlarge the effective measuring area of the force platform, collect and process measuring data from it.

4/ The system can calculate the resultant force, any component forces, their direction angles, the coordinates of the acting points of forces and force moment around the vertical axis.

5/ The system can calculate the extreme value of any data group, differential (one time or two times), integrate at any area. The system can also do data smoothing, spectrum analysis and statistical anlysis.

6/ Many kinds of curves (more than 4000 kinds of curves), vector graph and curve(s)-vector(s) synchronizing graphics can be displayed and edited on the CRT screen. All the data and analysis results can be stored and outputed by printer and ploter.

4. APPLICATION

This system was used in the biomechanical measurement for the women shot putting. In the test, three KISTLER FORCE PLATFORMS, a SELSPOT system and two high speed film cameras were synchronicaly operated. The three platforms enlarged the effective measuring area (from 400mm * 600mm to 600mm * 800mm), and the platform (1) and (2) can be composed as a large one.
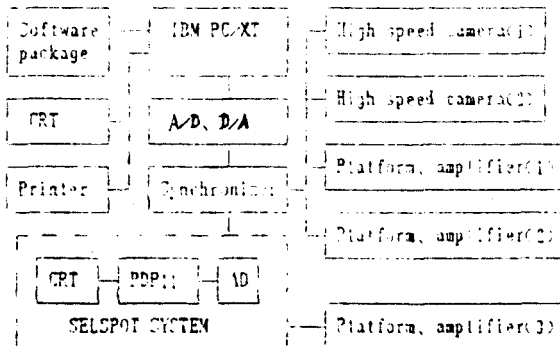

Figure 2: Application experiment.

We use the software package of our system and dBASE-III to process a large quantity of measured data. By those means, we got many meaningful results, such that, during the double stance phase, waist torque is one of main factors that influence the distance of shot putting; brake of the left leg plays a very important role on the effect of shot putting. We also found some faults in the performance of four elite national shot putters.

This system was used in teaching and research by other institutes of physical education.