

# Development and Research of Basketball Special Test System Based on Assembly Language

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**Abstract:** With the continuous development of computer technology and progress, the development of computer programs is more and more in-depth. In the sports specialty enrollment examination in Colleges and Universities, basketball special technology tests including the run-up Mogao test, basketball court four lines to and fro running test, one minute and three points shooting test and comprehensive technical testing. In the traditional sports test of basketball, the need to be equipped with a large number of human and material resources, and this test there are a lot of man-made factors resulting from the unfairness. In order to ensure the test fair, fair and fast, accurate. In this paper, a set of procedures for the special test of basketball is designed by computer assembly language; hope to provide help for the test and training of basketball players.

**Keywords:** Assembly language, basketball special test, computer platform, test system.

## 1. INTRODUCTION

This paper uses the assembly language programming, the main program includes the following aspects: system initialization, font information receiving, name information display, keyboard scanning, start, stop and illegal key program features, performance information, performance information sending. After resetting, first initialize the system, the microcontroller RAM, 8255 working modes are set in advance, then carries out the system self-test, normal open serial interrupt into the receiving program, there is no judgment PC machine to send "AA" string, received "AA" string, check whether SCM ready to received, if have been ready, return the string "BB", after waiting for PC to send PC font information, to send a message, is to open the font receiving MCU interrupt, after receiving of parity, if the information is incorrect, it returns the string "EE", PC re send the font information received correct, correct information after the MCU receives the information stored in the RAM area, close the serial interrupt and control LED screen display name, and then enter the keyboard scanning program, the "start" key is pressed, the timer T0 began to work time records the dribble, and sent to the LED screen display, a character representing 8\*16, press the button "goals", pitching a number plus 1, on the left side of the screen two shows the number of shots, right six display timing, "illegal" button when shooting a number minus one according to, "stop" at the press of a button to stop recording, and recording the data sent to the PC machine save to the database [1-3]. The flow chart of the program is shown in Fig. (1).

## 2. PROGRAM DESIGN

### 2.1. Serial Communication Program

The system using MCU serial communication port to realize the communication between the computer and, and receives information sent by the computer fonts, control LED display shows the correct information. SST89E564RD has a full duplex port can receive and transmit data at the same time, serialize to send to send and receive the special register SBUE write SBUF information will be loaded into the transmit registers, the read SBUF can get the receiving register. In order to ensure the correctness of received data, we need to develop the communication protocol between PC and single chip microcomputer: PC at regular intervals will send 3 "AA", using SCM interrupt mode to receive, if the SCM has made everything ready to receive the returns "BB", PC open initial sending font information, SCM after receiving were parity, if the data is correct, storage, if it is not correct, "EE" is returned, PC re send transmitting until the correct so far. SCM and computer communication between the need to set up the power control register PCON and serial control register SCON [4]. PCON\SCON is position defined as the Table 1:

SMOD1 double baud rate bit, when SMOD1=1, the timer 1 is used to generate the baud rate, serial mode with 1, 2, 3

SMODO FE/SMO selection

0: SCON [7]=SMO 1: SCON[7]=FE

Serial port control register (SCON), each position defined as shown in Table 2.

FE: frame error check mark

0: no frame error

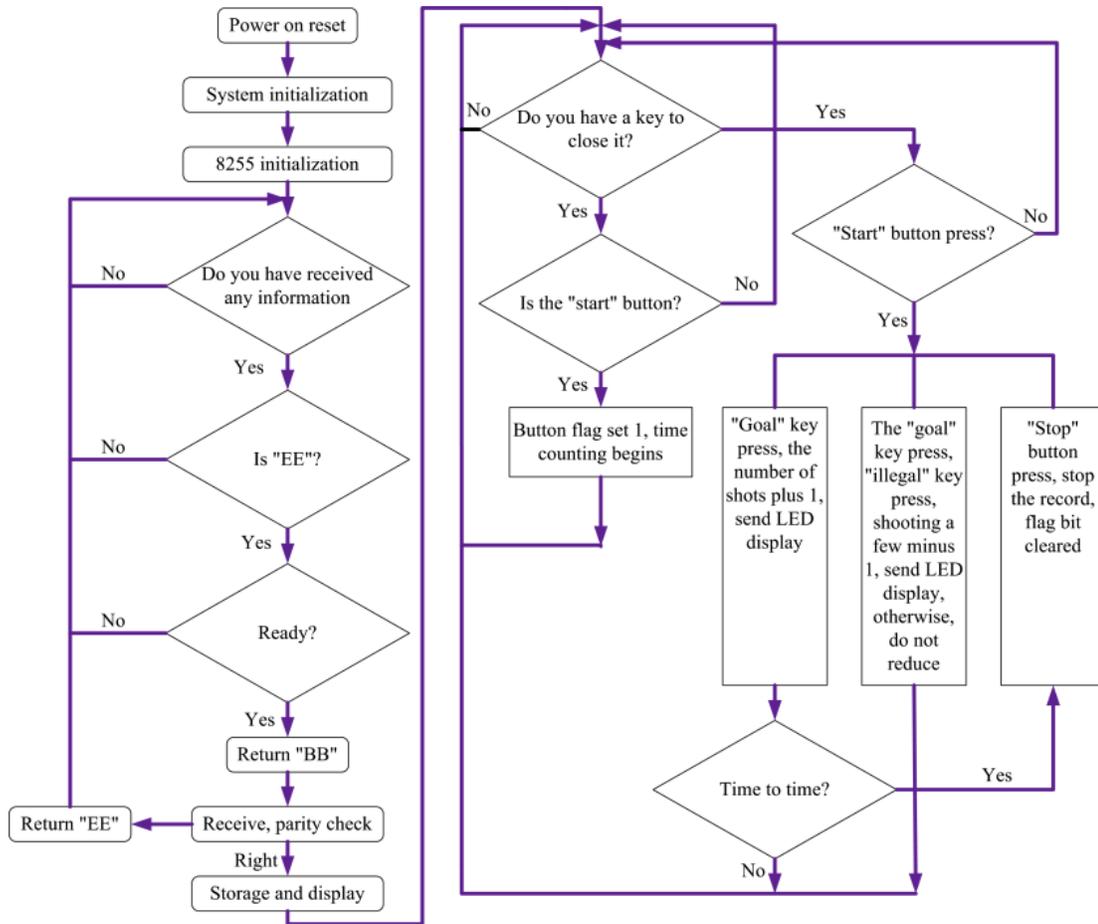


Fig. (1). System flow chart.

Table 1. PCON\SCON position defined.

7	6	5	4	3	2	1	0
SMOD1	SMOD0	BOF	POF	GF1	GF0	PD	IDL

Table 2. PCON\SCON position defined.

7	6	5	4	3	2	1	0
SMO/FE	SM1	SM2	REN	TB8	RB8	TI	RI

1: frame error, when detected an invalid stop, the bit is set by the UART receiver, but it must be cleared by the software.

SM1 SM0 serial mode select bit

The working mode of the serial port by SM0, to determine the combination of SM1, serial four working modes (as shown in Table 3), each mode, the SBUF register as instruction with a destination register will start sending data, receiving, in mode 0 [5]. When the SCON receive interrupt RI sign bit is cleared and SCON received allow/ban (REN) bit is set, began to receive, in other modes, when SCON Ren is already set, receiving in the start bit start [6].

SM2: mode 2 or 3 automatic address recognition enable bit, in model 2 or 3, if SM2 = 1 and received the nine data (RB8) is 0, then RI (receive interrupt flag) will not be activated, in model 1, if SM2 = 1 and did not receive effective stop bit, is RI is not activated, in mode 0, SM2 must be 0 [7].

REN: allows the receiving bit, by the software to set or reset

REN=1 allow receiving

REN=0 prohibition of receiving

TB8: mode 2 and ninth of the 3 bit data sent, you can press the required by the software to set or clear Ninth bit

Table 3. Working mode of serial port.

SM0	SM1	Pattern	Explain	Baud Rate
0	0	0	Synchronous shift register	fosc/12 (12 clock mode);or fosc/6(6 clock mode)
0	1	1	8-bit UART	Variable
1	0	2	9-bit UART	fosc/64 or fosc/32(12 clock mode) fosc/32 or fosc/16(6 clock mode)
1	1	3	9-bit UART	Variable

data that have been received in RB8 mode 2 and 3, or, or SM2=0, RB8 is the stop bit is received, and the RB8 is not used in mode 0.

RB8: mode 2 and ninth has received the 3 bit data in mode 1 or SM2=0, RB8 is the stop bit is received, the RB8 is not used in mode 0. RI receive interrupt flag [8]. Mode 0, receiving 8th by the end of the hardware set, other modes, the reception of stop bit in the middle of the moment, by the hardware position, in any model must be cleared by software RI.

TI: transmit interrupt flag, the mode 0, in the 8 bits of data are sent, by the hardware set, other mode, sending stop bit at the beginning, placed by the hardware, in any model must by software to remove Ti.

RI: receive interrupt flag. Mode 0, receiving 8th by the end of the hardware set, other modes, the reception of stop bit in the middle of the moment, by the hardware position, in any model must be cleared by software RI.

Between microcontroller and computer communication, both sides need to have the same baud rate and the communication rate, the microcontroller serial port has four working modes, which mode 0 and 2 baud rate is certain, and FOSC (crystal frequency) into a certain proportion, the baud rate of modes 1 and 3 is composed of a power supply control PCON registers the six SMOD1 timer and counter 1 overflow rate decision. This system adopts the timer/counter 1 baud rate, crystal 11.0592HZ [9].

Specific procedures are as follows:

```
ORG 0030H
ST: MOV SP,#60H
MOV TMOD. #20H; T1 Work in mode 2
MOV TH 1, #F3H
MOV TL1, #F3H: The baud rate is set to 1200
SETB TR1
MOV PCON. #00H; SMOD=0
MOV SCON. #50H; Select the serial mode 1
MOV R0, #20H
MOV R2,#30; Data number
LOOP: MOV A, @R0
MOV SBUF, A: Waiting to send out
```

```
WAIT: JBC T1, LOOP1
```

```
AJMP WAIT
```

```
LOOP1: JNC R0
```

```
DJNZ R2, LOOP
```

```
END
```

## 2.2. Name of the Display Program

With the PC microcontroller through the communication between the receiver name dot matrix information, and stored at the start of the RAM TAB0, displays the name first established 8 buffer, used to store the names of all the Chinese characters line dot matrix information, and then set the scan line and scan code will be displayed for the preset initial value, as the first row first, the data in the buffer to the P1.3 port, P1.3 and 74LS595 SER is connected with the end of 595, data input, data from P1.3 with carry shift, lattice information 8 ranked in the 595 of the shift pulse by shifted into the shift register, when a byte shift ended, the lattice information within the buffer output in the same way to the next shift [10, 11]. When all the information in the buffer is shifted into the 74LS595, the RCK pulse of the 74LS595 is set, so that the data is entered into the data storage register by the shift register.

To choose access driver signal and realize the first line of information display, a time delay in the same way show additional lines, line and the line between rotation, the finally realize the name in the presentation of LED display, as shown in Fig. (2).

Will buffer the Chinese character dot matrix information sequentially shift into the 74ls595 shift registers, and the set of RCK pulse and the data by 74ls595 shift register into the data storage register.

## 2.3. Timing Program Design

Basketball test time part of the time to achieve the accuracy of the time, we use the timer/counter T0 timer interrupt mode [12]. Timer/counter T0 has four working modes that can be set up by setting the value of the TMOD register. T0 0 is a 13 bit counter/timers. Mode 1 is a 16 bit timer/counter and method 2 is 8-bit auto reload timer/counter, 3 t0 as two 8-bit timer/counter. The test requirements of basketball dribble time accurate to the second, so the use of 12MHZ crystal in the system, the working mode of T0 1, timed 0.1 seconds.

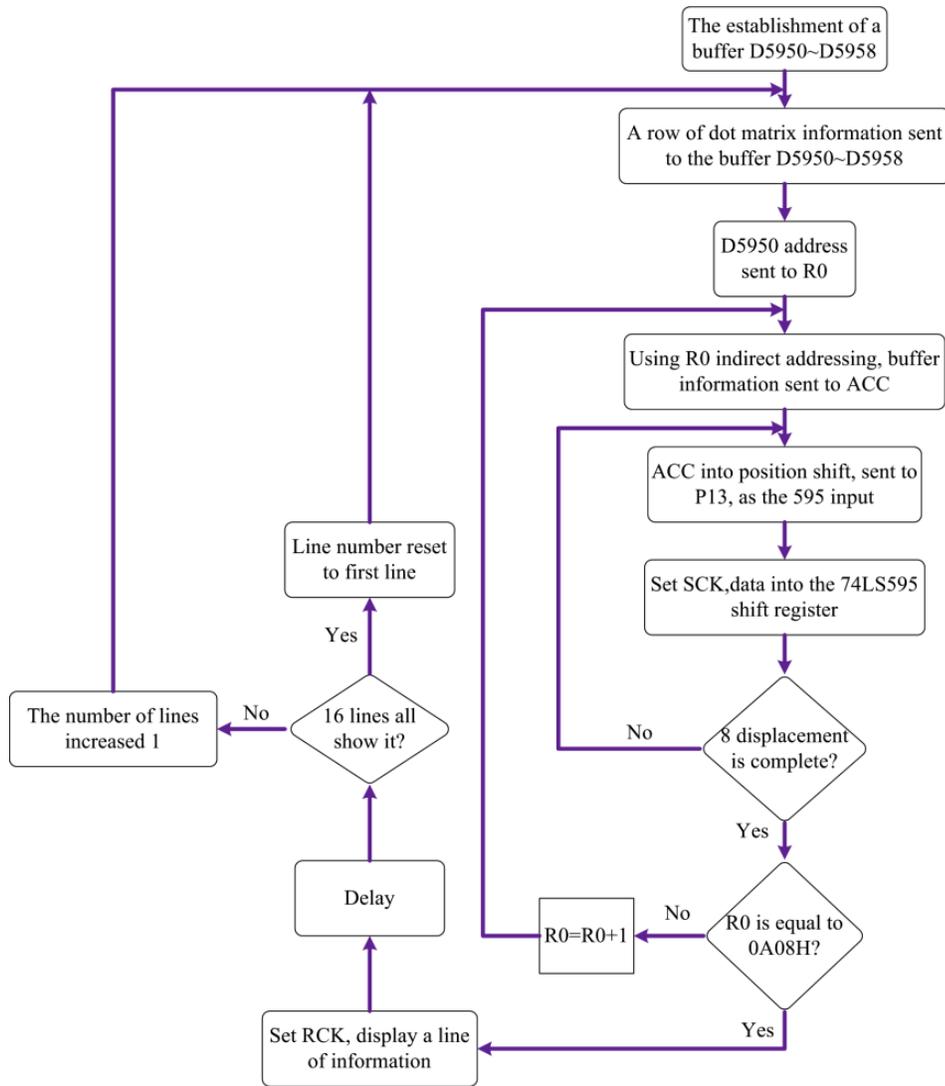


Fig. (2). Name display program flow chart.

2.4. Interrupt Program

SST89E564RD contains eight medium and cut off the source, and each interrupt source allocation of space for eight unit, if the interrupt service program is longer, obviously not enough space, so program design, general interrupt source entry address to write an unconditional jump instruction in, when the interrupt occurs, the corresponding overflow sign bit by hardware is set to 1, program jumps to the user to write interrupt program [13]. At the same time, by the hardware will interrupt flag bit is cleared to 0. SST89E564RD type single chip timer/counter T0 interrupt entry address is 000BH, the program of the timer/counter T0 interrupt entry address is written as follows:

```

ORG 000BH
AJMP ZDFW
  
```

Basketball test requirements dribble time accurate to the second, so we in the program design selection time of 0.1 seconds, generate an interrupt, interrupt condition is satisfied, the CPU corresponding interrupt, very seconds value plus 1, when is second count to 10, clear, seconds value plus 1.

2.5. The Results Display Program

Some students' grades, including shooting and dribbling time and shot number accounted for two characters, namely 2 8\*16LED dot matrix module, dribble time contains the minutes and seconds, accounted for four characters, 4 8\*16LED dot matrix module, a said minutes, a display a colon (:), two shows the number of seconds [14]. The number of shooting and dribbling time between LED lights, two spaced, to facilitate the view. In the results show before the first to do the following two aspects:

First, the establishment of the font table TAB1, the character of the dot matrix information in the form of sixteen in the form of the. Partial result is used in the system characters including "0" to "9", "" and "J" a total of 12 characters, display, will send shaped table the first address tab1 DPTR, to display the number into a register, each character dot matrix information difference address numbers into register B (16), through a multiplied by B to display the number of dot matrix information first address, and scan the rows sum as an offset to the address and by MOVC instruction removed corresponding character dot matrix information.

Second, establish a buffer D5958 ~D595F, dot matrix information for memory scores in a total of 8 bytes, each buffer content corresponds to a 74ls595, display, through the cycle in turn will buffer content into the accumulator a, a by displacement of the carry bit shift register into the 74ls595 [15]. When a row of data shift after the completion of, set a RCK pulse to realize the data into the data storage register and keep, for strobe signal gating, to achieve the display.

**2.6. BCD Code Separation Subroutine**

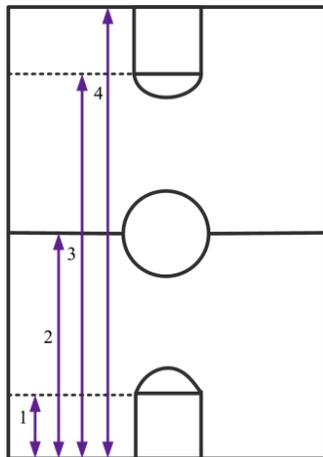
Binary coded decimal is a form of decimal digital code. Each decimal digit of this code uses a string of individual bits to store the representation. A common four said a decimal number, known as compressed or packed; or 8-bit said a decimal number, called uncompressed or zoned [16]. In the computer internal record data generally uses the binary way, but in the single chip microcomputer terminal display, need to transform the binary data into the corresponding BCD code, can realize the display. In the shooting and dribbling time is the binary is stored in the ram of the MCU, the display must be transformed into BCD code.

**3. APPLICATION ANALYSIS**

This paper selects 10 basketball athletes using this system the basketball court four lines to and fro running test, the run-up Mogao test, one minute and three points shooting test; you can see the athletes of the special achievement and total achievement from the LED display [17]. The contents of the tests and the results are as follows.

**3.1. basketball Court Four Lines to and fro Running Test**

Athletes in the 1, 2, 3, 4 order of the whole process, start from the side of the baseline, after hearing the signal, starting to proximal to the free throw line emergency stop, turned around quickly returning to the starting line, emergency stop turn, run to the midline, returning to the baseline, emergency stop turned and ran to the other side of the free throw line, returning to the original starting line emergency stop turn, and ran to the other side of the baseline, retracing the sprint to the original starting backcourt, as shown in Fig. (3).



**Fig. (3).** Basketball court four lines to and fro running test sketch map.

**Table 4.** Basketball special basketball court four lines to and fro running test report.

Name	Results	Score
Abby	32"23	15
Cora	31"38	17
Kellen	29"53	20
Ken	31"77	16
Tracy	31"50	18
Phoebe	32"28	15
Pearl	31"55	16
Joy	28"76	20
Kael	30"22	19
April	32"83	14

**Table 5.** Basketball special the run-up mogao test report.

Name	Results (m)	Score
Abby	3.22	20
Cora	3.18	19
Kellen	3.25	20
Ken	3.14	18
Tracy	3.11	16
Phoebe	3.13	17
Pearl	3.17	18
Joy	3.18	19
Kael	3.12	16
April	3.18	19

Every time retracing must have one foot line before retracing. Otherwise, for the first time don't tread on the line shall be given a warning, the second don't tread on the line is sentenced to foul and cancel the test result. Each candidate must run two times, 40 seconds rest between each, the average score of the two tests for the project's final score, test results are shown in Table 4.

**3.2. The Run-up Mogao Test**

One foot jump run-up Mogao, each two times, with a high performance measurement touches high, once the best performance.

The results of the athletes are shown in Table 5.

**3.3. One Minute and Three Points Shooting Test**

The basket in the projection of the field as the center of a circle, respectively, to 4 meters (4 and 5 players limit selec-

**Table 6. Basketball special one minute and three points shooting test report.**

Name	Results	Score
Abby	7	18
Cora	6	16
Kellen	7	18
Ken	9	20
Tracy	6	16
Phoebe	6	16
Pearl	8	20
Joy	8	20
Kael	8	20
April	7	18

tion), 5 meters radius from baseline on to the pitch row arc (arc width 5 cm), and on the three-point line constitute three different shooting positions for the candidates to choose. Shooting time is 1 minutes, the test selection with a radius of 5 m from the end to the pitch arc.

#### Test requirements

First, the candidates must be self-cast in the way to test;

Second, when shooting, if the foot line, according to the low score calculation area;

Third, when shooting, appeared to be running with the ball or two dribble, otherwise it will be ruled illegal, invalid vote;

Fourth, no limited to shooting method;

Fifth, each person can test two times, get the best one time.

The results of the athletes are shown in Table 6.

After three rounds of testing, the system has drawn a comprehensive test results for each athlete, and displayed on the LED, the total scores of athletes are shown in Table 7.

From these three tests can be seen, basketball special automatic test system has been successfully applied to the practical tests, the application of the system improves the basketball test of scientific, accurate and public, to eliminate the artificial timing, counting and recording results of error, improves the test efficiency, reduces the assessment exam the labor intensity of the, effectively prevent the cheating in the examination. Scientific, open and impartial examination, scientific selection of outstanding talent provides powerful techniques.

## CONCLUSION

The in assembly language based design conforming to the basketball special testing of the indicators system, demonstrated by a lot of practice, the system is very reliable, makes the examination more fair, also make the athletes

**Table 7. Basketball special test athletes report.**

Name	Score
Abby	53
Cora	52
Kellen	58
Ken	54
Tracy	50
Phoebe	48
Pearl	54
Joy	59
Kael	55
April	51

have a clearer understanding of their indicators. Facts have proved that the rational use of computer technology can bring great convenience for our life and production, so that we have more human and material resources into emerging in the development of science and technology.

## CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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