



## Cloud real-time single-elimination tournament chart system

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**Abstract:** The authors have developed a cloud real-time single-elimination tournament chart system. The user can easily create a tournament online. Each team can easily sign up in the system. The tournament scheduling can draw online and draw real-time match score. According to the time setting, the system establishes a timetable figure. The users can download this timetable to a client computer and use Microsoft Excel to modify the table number, date and time cells. After the modification has been updated, the users can upload the timetable to the cloud system. Finally, this system enables everyone to watch the tournament charts online. After the match finishes, the computer operator inputs the score of each match. The cloud system will compute the tournament charts and progress to the next event match. This system is a complete cloud real-time single-elimination tournament chart system.

**Keywords:** Cloud Computing, Tournament Charts System, Table Tennis

### I. INTRODUCTION

Using computer programs to arrange the time schedule is the trend in table tennis tournaments, particularly in the ITTF-PTT (International Table Tennis Federation, Para Table Tennis) game, through the usage of DR. WU's program (Wu, 2011). DR. WU's programs can provide a time schedule and output the battle chart, match time and score sheets. However, it cannot show the real-time competition chart, draw results and display the score to all players and officials. It is very important to obtain the results of the games in real time (Yukihiko U., Tohru T., Hisato I., & H., 2010). Therefore, we used cloud-computing technologies to solve this problem.

Cloud computing involves deploying groups of remote servers and software networks that enable centralized data storage and online access to computer services or resources. The clouds can be classified as public, private or hybrid (Hassan & Qusay, 2011). Therefore, it can enable umpires to log in quickly and in real time to input the scores and show the latest results to everyone watching the game.

This system applied to single-elimination tournament charts in table tennis. It establishes a registration system for organizers to obtain player information from the database. It expedites the referee's task of arranging the time schedule and produces the schedule in real time for everyone. This system is a completely new system for table tennis tournaments (Figure 1, Figure 2 and Figure 3).

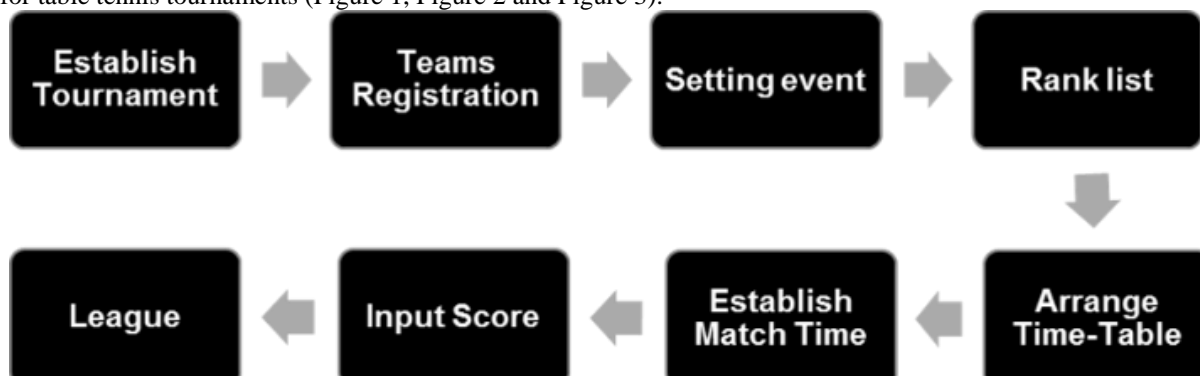


Figure 1. Basic concept of the process

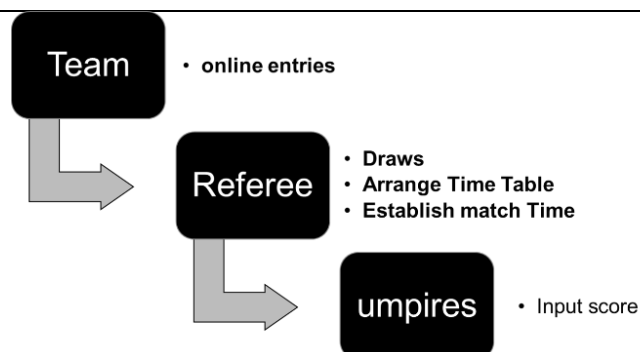


Figure 2. Responsibilities of different identities

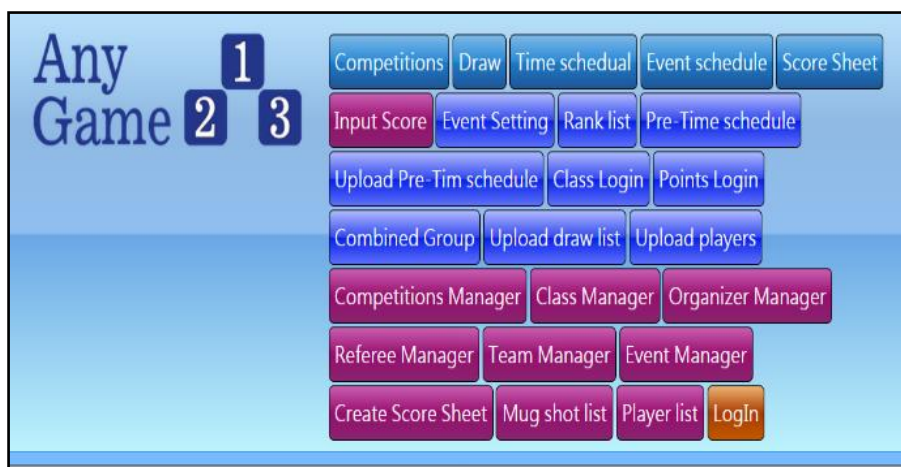


Figure 3. Login in different identities  
 (Light Blue: Everyone; Navy blue: Referee; Red: Organizers)

## II. RELATED WORK

System Specs was used: host: WIN2008; web: HTML5 and CSS3; scripts: JavaScript; program: ASP; Database: ACCESS and MYSQL. The procedure is as follows.

### 2.1 Establish the Tournament

The organizers establish an event, set the event name, date, deadline, competition rules, referee technique delegate, and merge event keyword.

### 2.2 Team Registration

According to the organizers' setting of the event, the teams register the staff and players. The teams can choose the accommodation day and clothing sizes.

Each team member must provide each player's information. The player can also make amendments before a certain cut-off time.

### 2.3 Setting event

The seeded player, table numbers, and estimated time for each match can be set. In particular, the seed must be in the correct position (Jacobson, Nikolaev, King, & Lee, 2011). However, the number of seeds will not affect the seed of winning (Khatibi, King, & Jacobson, 2015).

### 2.4 Rank list

According to the number of seeds and player points, the system can draw the position of each player, which corresponds to the ITTF 3.6.2 and 3.6.3 rules (The International Table Tennis Federation Handbook on Table Tennis, 2015), 3.6.3.1 and 3.6.3.2 in particular, as cited below. The system can also re-draw in this step.

3.6.3.1 Nominated players and pairs of the same Association shall, as far as possible, be separated so that they cannot meet before the closing rounds of an event.



3.6.3.2 Associations shall list their nominated players and pairs in descending order of playing strength, starting with any players included in the ranking list used for seeding, in the order of that list.

## 2.5 Arrange the Timetable

According to the established event, the system arranges a timetable. The timetable is divided into two modes (Figure 4, Figure 5): one is based on different events, where different matches are included in the timetable, and the other is based on different match levels, where different event levels are arranged in the same time slot. It is possible to avoid an empty table. The time conflict question is also considered. No player appears in 2 tables in a time section. The system will attempt to maximize the usage of the table. No player appears twice in a specified time slot, which can dramatically increase the size of the timetable compared to the referee-arranged timetable.

Date	Time	Table1	Table2	Table3	Table4	Table5	Table6	Table7	Table8
02/10	09:00	OM3 top128-1	OM3 top128-2	OM3 top128-3	OM3 top128-4	OM3 top128-5	OM3 top128-6	OM3 top128-7	OM3 top128-8
02/10	09:20	OM3 top128-9	OM3 top128-10	OM3 top128-11	OM3 top128-12	OM3 top128-13	OM3 top128-14	OM3 top128-15	OM3 top128-16
02/10	09:40	OM3 top128-17	OM3 top128-18	OM3 top128-19	OM3 top128-20	OM3 top128-21	OM3 top128-22	OM3 top128-23	OM3 top128-24
02/10	10:00	OM3 top128-25	OM3 top128-26	OM3 top128-27	OM3 top128-28	OM3 top128-29	OM3 top128-30	OM3 top128-31	OM3 top128-32
02/10	10:20	OM3 top128-33	OM3 top128-34	OM3 top128-35	OM3 top128-36	OM3 top128-37	OM3 top128-38	OM3 top128-39	OM3 top128-40
02/10	10:40	OM3 top128-41	OM3 top128-42						
02/10	11:00	OM3 top64-1	OM3 top64-2	OM3 top64-3	OM3 top64-4	OM3 top64-5	OM3 top64-6	OM3 top64-7	OM3 top64-8
02/10	11:20	OM3 top64-9	OM3 top64-10	OM3 top64-11	OM3 top64-12	OM3 top64-13	OM3 top64-14	OM3 top64-15	OM3 top64-16
02/10	11:40	OM3 top64-17	OM3 top64-18	OM3 top64-19	OM3 top64-20	OM3 top64-21	OM3 top64-22	OM3 top64-23	OM3 top64-24
02/10	12:00	OM3 top64-25	OM3 top64-26	OM3 top64-27	OM3 top64-28	OM3 top64-29	OM3 top64-30	OM3 top64-31	OM3 top64-32
02/10	12:20	OM3 top32-1	OM3 top32-2	OM3 top32-3	OM3 top32-4	OM3 top32-5	OM3 top32-6	OM3 top32-7	OM3 top32-8
02/10	12:40	OM3 top32-9	OM3 top32-10	OM3 top32-11	OM3 top32-12	OM3 top32-13	OM3 top32-14	OM3 top32-15	OM3 top32-16
02/10	13:00	OM3 top16-1	OM3 top16-2	OM3 top16-3	OM3 top16-4	OM3 top16-5	OM3 top16-6	OM3 top16-7	OM3 top16-8
02/10	13:20	OM3 top8-1	OM3 top8-2	OM3 top8-3	OM3 top8-4				
02/10	13:40	OM3 top4-1	OM3 top4-2						
02/10	14:00	OM3 1/2							
02/10	14:20	OM4 top128-1	OM4 top128-2	OM4 top128-3	OM4 top128-4	OM4 top128-5	OM4 top128-6	OM4 top128-7	OM4 top128-8
02/10	14:40	OM4 top128-9	OM4 top128-10	OM4 top128-11	OM4 top128-12	OM4 top128-13	OM4 top128-14	OM4 top128-15	OM4 top128-16
02/10	15:00	OM4 top128-17							
02/10	15:20	OM4 top64-1	OM4 top64-2	OM4 top64-3	OM4 top64-4	OM4 top64-5	OM4 top64-6	OM4 top64-7	OM4 top64-8
02/10	15:40	OM4 top64-9	OM4 top64-10	OM4 top64-11	OM4 top64-12	OM4 top64-13	OM4 top64-14	OM4 top64-15	OM4 top64-16
02/10	16:00	OM4 top64-17	OM4 top64-18	OM4 top64-19	OM4 top64-20	OM4 top64-21	OM4 top64-22	OM4 top64-23	OM4 top64-24
02/10	16:20	OM4 top64-25	OM4 top64-26	OM4 top64-27	OM4 top64-28	OM4 top64-29	OM4 top64-30	OM4 top64-31	OM4 top64-32
02/10	16:40	OM4	OM4	OM4	OM4	OM4	OM4	OM4	OM4

Figure 4. Discontinuous stack modes of the auto-arranged Time Table

Date	Time	Table1	Table2	Table3	Table4	Table5	Table6	Table7	Table8
02/10	09:00	OM3 top128-1	OM3 top128-2	OM3 top128-3	OM3 top128-4	OM3 top128-5	OM3 top128-6	OM3 top128-7	OM3 top128-8
02/10	09:20	OM3 top128-9	OM3 top128-10	OM3 top128-11	OM3 top128-12	OM3 top128-13	OM3 top128-14	OM3 top128-15	OM3 top128-16
02/10	09:40	OM3 top128-17	OM3 top128-18	OM3 top128-19	OM3 top128-20	OM3 top128-21	OM3 top128-22	OM3 top128-23	OM3 top128-24
02/10	10:00	OM3 top128-25	OM3 top128-26	OM3 top128-27	OM3 top128-28	OM3 top128-29	OM3 top128-30	OM3 top128-31	OM3 top128-32
02/10	10:20	OM3 top128-33	OM3 top128-34	OM3 top128-35	OM3 top128-36	OM3 top128-37	OM3 top128-38	OM3 top128-39	OM3 top128-40
02/10	10:40	OM3 top128-41	OM3 top128-42	OM4 top128-1	OM4 top128-2	OM4 top128-3	OM4 top128-4	OM4 top128-5	OM4 top128-6
02/10	11:00	OM4 top128-7	OM4 top128-8	OM4 top128-9	OM4 top128-10	OM4 top128-11	OM4 top128-12	OM4 top128-13	OM4 top128-14
02/10	11:20	OM4 top128-15	OM4 top128-16	OM4 top128-17	OM5 top128-1	OM5 top128-2	OM5 top128-3	OM5 top128-4	OM5 top128-5
02/10	11:40	OM5 top128-6	OM5 top128-7	OM5 top128-8	OM5 top128-9	OM5 top128-10	OM5 top128-11	OM5 top128-12	OM5 top128-13
02/10	12:00	OM5 top128-14	OM5 top128-15	OM5 top128-16	OM5 top128-17	OM5 top128-18	OM5 top128-19	OM5 top128-20	OM5 top128-21
02/10	12:20	OM5 top128-22	OM5 top128-23	OM5 top128-24	OM5 top128-25	OM5 top128-26	OM5 top128-27	OM5 top128-28	OM5 top128-29
02/10	12:40	OM5 top128-30	OM5 top128-31	OM5 top128-32	OM5 top128-33	OM5 top128-34	OM6 top128-1	OM6 top128-2	OM6 top128-3
02/10	13:00	OM6 top128-4	OM6 top128-5	OM6 top128-6	OM6 top128-7	OM6 top128-8	OM6 top128-9	OM6 top128-10	OM6 top128-11
02/10	13:20	OM6 top128-12	OM6 top128-13	OM6 top128-14	OM6 top128-15	OM6 top128-16	OM6 top128-17	OM6 top128-18	OM6 top128-19
02/10	13:40	OM6 top128-20	OM6 top128-21	OM6 top128-22	OM6 top128-23	OM6 top128-24	OM6 top128-25	OM6 top128-26	OM6 top128-27
02/10	14:00	OM6 top128-28	OM6 top128-29	OM6 top128-30	OM6 top128-31	OF3 top64-1	OF3 top64-2	OF3 top64-3	OF3 top64-4
02/10	14:20	OF3 top64-5	OF3 top64-6	OF3 top64-7	OF5 top64-1	OF4 top32-1	OF4 top32-2	OF4 top32-3	OF4 top32-4
02/10	14:40	OF4 top32-5	OF4 top32-6	OF4 top32-7	OF4 top32-8	OF4 top32-9	OF5 top32-1	OF5 top32-2	OF5 top32-3
02/10	15:00	OF5 top32-4	OF5 top32-5	OF5 top32-6	OF5 top32-7	OM3 top64-1	OM3 top64-2	OM3 top64-3	OM3 top64-4
02/10	15:20	OM3 top64-5	OM3 top64-6	OM3 top64-7	OM3 top64-8	OM3 top64-9	OM3 top64-10	OM3 top64-11	OM3 top64-12

Figure 5. Continuous stack modes of the auto-arranged Time Table



After the model is determined, the 'time schedule.xls' file is downloaded and can be opened with Microsoft Excel. The referee can move the match in the time schedule if necessary. Finally, the latest time schedule can be uploaded to the cloud system.

### 2.6 Establish Event Results Table

After the above steps are completed and when the system has drawn the position list and a time schedule, a merge can be executed. The merge will show the data timetable for all matches and all players.

### 2.7 Input Score Sheet

When the scorekeeper uses an iPad or computer to login, he/she clicks the match whose score can be input online (Figure 6). After the score has been input, the score will be immediately shown online. The KO draw will be immediately displayed, the winner will be displayed as a thick red line for promotion. The system is ideal for anyone who is interested in the latest match updates.

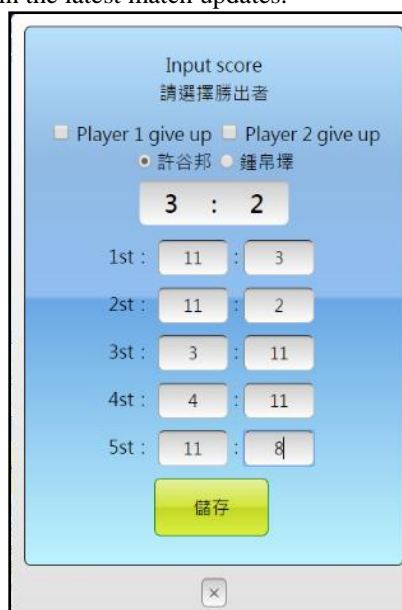


Figure 6. Input Score Sheet

### 2.8 League Table

After the entire score sheet is input, the system will show the league table. It can also show the match report and medalists (Figure 7, Figure 8).

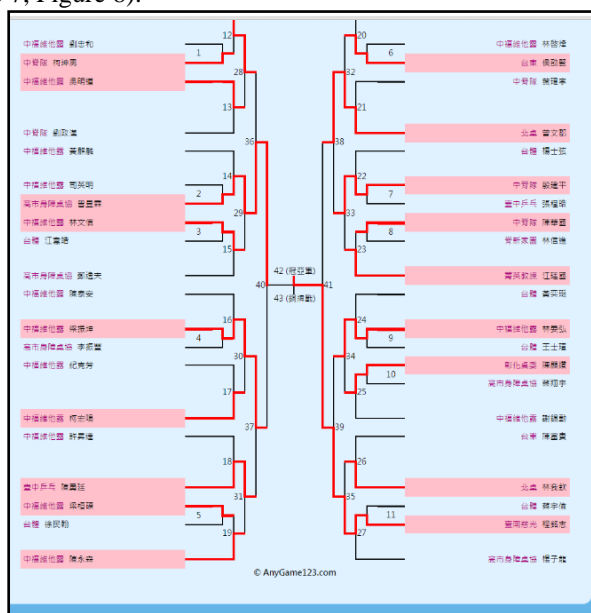


Figure 7. Promotion red line and score sheet were synchronized online



Seg	Table	Time	Match	Opponent1	Opponent2	Game	Best of 3,5 or
1	1	10-5,09:00	1 OMTT5.top64-1	中僑維他露,劉忠和	中曾隊,●何坤勇	0:3 7:11,7:11	5
2	2	10-5,09:00	2 OMTT5.top64-2	中僑維他露,司英明	高市身障桌球,●曾昱昇	0:3 10:12,6:11	5
3	3	10-5,09:00	3 OMTT5.top64-3	中僑維他露,●林文德	台體,江書揚	3:0 11:4,11:8	5
4	4	10-5,09:00	4 OMTT5.top64-4	中僑維他露,●張振坤	臺市身障桌球,李振豐	3:0 11:0,11:0	5
5	5	10-5,09:00	5 OMTT5.top64-5	中僑維他露,●梁恒謙	台體,徐良翰	3:3 11:6,9:11,11:13, 11:5	5
6	6	10-5,09:00	6 OMTT5.top64-6	中僑維他露,林銘偉	台東,●陳勁豐	1:3 11:7,7:11,9:11	5
7	7	10-5,09:00	7 OMTT5.top64-7	中曾隊,●趙建平	臺中,邱振輝	3:0 11:6,11:9	5
8	8	10-5,09:00	8 OMTT5.top64-8	中曾隊,●陳學聖	崑崙山,林偉佳	3:1 11:8,11:4,11:7	5
9	1	10-5,09:30	9 OMTT5.top64-9	中僑維他露,●林榮弘	台體,王士瑋	3:0 11:4,11:3	5
10	2	10-5,09:30	10 OMTT5.top64-10	彰化桌球,●陳勝權	臺市身障桌球,蔣初平	3:0 11:0,11:0	5
11	3	10-5,09:30	11 OMTT5.top64-11	台體,陳宇倫	臺南,●程格志	0:3 8:11,4:11	5
12	4	10-5,09:30	12 OFTT5.top32-1	台東,林伊朋	北風,●趙旻華	0:3 6:11,8:11	5
13	5	10-5,09:30	13 OFTT5.top32-2	中僑維他露,●陳聖勇	北新國中,廖錫豐	3:0 11:2,11:2	5
14	6	10-5,09:30	14 OFTT5.top32-3	彰化桌球,林千豪	臺南,●林晉豐	0:3 3:11,4:11	5
15	7	10-5,09:30	15 OFTT5.top32-4	中僑維他露,陳慶芬	中曾隊,●吳玟庭	1:3 5:11,9:11,8:11	5
16	8	10-5,09:30	16 OFTT5.top32-5	北風,●盧贊書	北新國中,倪國浩	3:0 11:2,11:1	5
17	1	10-5,10:00	17 OMTT5.top32-12	中僑維他露,●周明修	#1 何坤勇	3:1 11:8,11:6,11:9,0:	5
18	2	10-5,10:00	18 OMTT5.top32-13	中僑維他露,●周明謙	中曾隊,劉政華	3:1 11:7,9:11,11:8	5
19	3	10-5,10:00	19 OMTT5.top32-14	中僑維他露,黃勝軒	#2 ●曾昱昇	1:3 5:11,4:11,6:11	5
20	4	10-5,10:00	20 OMTT5.top32-15	#3 ●林文德	臺市身障桌球,謝德夫	3:0 11:0,11:0	5
21	5	10-5,10:00	21 OMTT5.top32-16	中僑維他露,陳嘉炎	#4 ●張振坤	2:3 11:6,7:11,3:11,5: 11	5

Figure 8. Scores were synchronized online.

### III. RESULTS

This system was introduced in the TTTA (Taiwan Table Tennis Taiwan Association), 2014 National Junior Table Tennis elite tournament and 2015 National Junior Table Tennis elite tournament.

During the 2015 National Junior Table Tennis elite tournament, 2785 athletes participated in the competition. The competition was divided into four age groups, for boys and girls, and four separate qualifying areas.

Because the teams must register the competition on paper (to be under seal), the players' data were collected and imported into the system. Instead of using the online registration, the system must set the player's point and number of seeded players. Before the data are imported, the data can be drawn online.

Each group of draw was completed in less than a second according to the ITTF rules. The system also gives the output of Battle figure, and the athletes and spectators can easily and quickly view the ballot results.

The system calculates all match schedules. Then, it arranges the optimal time schedules. It can produce a data timetable chart and match time for all players. The time scheduling and draws were successful and swiftly done.

When the umpires input a score sheet, each umpire has an account to log into the system. The umpire can input the score of the match. The referee also has an account, which helps him check all competition results in real time. Because some umpire could not use the iPad or smart phone to input the score, the score sheet was manually input by a computer technician.

### IV. DISCUSSION

The popularity of online registration systems remains uncommon. Not every participating team prefers to use a registration system.

In addition, not every referee is good at handling computers. Even now, not every umpire uses the internet system to enter scores. Some umpires continue using primitive methods such as pen and paper.

Cloud computing helps to draw the game in a fast and convenient manner. It enables everyone to know the results immediately. In this modern time, the cloud computing method should be used to assist table tennis games. There should be a systematic standard operating procedure and a user manual for referees and umpires.



## V. CONCLUSION

In the past, there was only a simple online system for tournaments (Walker & Jorasch, 1998). Now, because cloud-computing development has become increasingly popular, we recommend this system, and it should be extended to all other countries.

The system must be established in multiple languages to be used in most countries. The technical committee members and referee should regularly convene to discuss the system design, so everyone can more conveniently use the system.

## VI. Acknowledgements

New Future Digital Company Support for development systems.

## REFERENCES

This heading is not assigned a number.

### Journal Papers:

- [1] W.J. Book, Modelling design and control of flexible manipulator arms: A tutorial review, Proc. 29th IEEE Conf. on Decision and Control, San Francisco, CA, 1990, 500-506 (8)
- [2] Hassan, & Qusay. (2011). Demystifying Cloud Computing. *The Journal of Defense Software Engineering*, 16-21.
- [3] Jacobson, S. H., Nikolaev, A. G., King, D. M., & Lee, A. J. (2011). Seed distributions for the NCAA men's basketball tournament. *Omega*, 39(6), 719-724.
- [4] Khatibi, A., King, D. M., & Jacobson, S. H. (2015). Modeling the winning seed distribution of the NCAA Division I men's basketball tournament. *Omega*, 50(0), 141-148.
- [5] The International Table Tennis Federation Handbook on Table Tennis. (2015).
- [6] Walker, J. S., & Jorasch, J. A. (1998). Washington Patent No. U.S.: P. a. T. Office.
- [7] Wu, C.-S. (2011). Table tennis draw and competition program in Excel. Retrieved from <http://dr.wu.free.fr/draw/>
- [8] Yukihiro U., Tohru T., Hisato I., & H., O. (2010). Real-time Chart System of Table Tennis Tournaments on the Internet. *International Journal of Table Tennis Sciences*, 6, 155-159.