

# THE SELECTION OF STARTING FIVE PLAYERS FOR BASKETBALL TEAM USING PROFILE MATCHING METHOD, CASE STUDY: UNIVERSITY OF SURABAYA BASKETBALL TEAM

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## Abstract

The formation of a main basketball team eligible for playing a basketball match is determined by several factors, namely players' position within the game, players' physical and mental abilities, as well as players' technical abilities. There are five positions for a basketball player: playmaker, shooting guard, small forward, power forward, and center. Each of these positions have specific responsibilities and require different skills. Each skill is further divided into some specific skills.

Every basketball player surely wants to be selected as a representative for a match. Therefore, players compete each other to show their abilities. Because of evenly-distributed and equal abilities from each player, as well as many factors to be considered, coaches often face difficult decisions to form the main team that consists of best players for each position for a particular match. In this research, we developed an application to assist coaches on deciding the main basketball team to be sent to a competition. The main team is determined by specific criteria and coach's strategies. This application is developed using Profile Matching method. Profile Matching works by comparing actual data values of a profile with expected profile values. Any values produced will be used as ideal predictor variables for each player. Validation is performed with two University of Surabaya (Ubaya) coaches and one assistant, as well as 20 basketball players. It shows that the decision support system helps coaches in determining main basketball team for Ubaya and players in motivating themselves to be the best players.

**Keywords:** basketball, decision support system, profile matching, starting five

## INTRODUCTION

With high enthusiasm for basketball, players compete each other to show the best among the best. This positive competition encourages sportsmanship and good teamwork. This can be seen in abundance of basketball team and players in Indonesia which have good skills at every level and position. Because of this, however, coaches are often puzzled on determining main players to fill in each position, forming the main team, for each match. Players at playmaker, shooting guard, small forward, power forward, and center positions have different tasks.

Criteria on determining players who fit certain position are numerous, such as technical, mental, and physical aspects. Technical criteria consist of dribbling, two-point shoot, three-point shoot, marking, passing, free throw, and technique. Mental criteria consist of bravery, teamwork, and self-discipline. Meanwhile, physical criteria consist of agility, speed, power, jump, and strength endurance.

The number of criteria to be considered and a comparable performance from the players make coaches difficult to decide the main team to be sent to a competition. Incorrect determination of the main team can cause defeat. To overcome these problems, in this research, we developed an application to assist coaches on determining the main basketball team to be sent to a competition. Main team determination is done by criteria and strategy of coach based on available players' statistics.

## METHODOLOGY

In this paper, we will use a case study of University of Surabaya (Ubaya, IPA /u:ba:ja:/) basketball team. Development of the DSS system follows the software development life cycle: planning, analysis, design, implementation, and testing. First of all, we gather all data related to the proposed system, such as references about DSS, profile matching method, and related works; basketball statistics and their usage on determining the starting five players, as well as data gathering from Ubaya coach. On the analysis phase, we conduct an interview with an Ubaya coach and his assistant to analyze current problem and learn how a main team is formed. Analysis is done by studying how coach selects main team according to a number of criteria and coach strategy. This phase results in identified problems that need to be solved using the DSS, mainly about the starting five players' selection. On the design phase, we create an entity-relationship diagram (ER-D) based on current system and proposed solutions and map the diagram into MySQL database and respective tables. We also design the user interface using Web usability guides, as not all targeted users are already familiar with Website. Entering the implementation phase, we develop the DSS using PHP and JavaScript as well as HTML and CSS. After the implementation is completed, we conduct a black-box testing by asking one coach and one assistant to use the DSS. Although players can only see each other statistics and presence on the system, we also test it using random sample method

by randomly selecting 20 out of 36 basketball players. These 20 players are asked to use the Website to test its functionality, then answer some questions regarding to the Website. We end the development by concluding the results and writing documentations for future use and further research.

## RESULT AND DISCUSSION

Prior to the DSS development, we review a selection of similar works on DSS, to select a method that will be used on our DSS. One example is a fuzzy AHP approach to personnel selection problem (Güngör, et al., 2009). A similar DSS for basketball player selection was developed using combination of two methods: FAHP and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), which yielded satisfactory results (Ballı & Korukoğlu, 2014). Upon determining the method to use, we discovered profile matching method (also known as gap analysis) that is suitable enough for our problem. Profile matching is first proposed as a service quality model (Parasuraman, et al., 1985), by comparing the gap between available profiles and desired profiles. We think that this method is also suitable for selecting the best candidates out of required criteria (both qualitative and quantitative) and candidate statistics, as shown in related works (Iqbal, et al., 2014)(Saat & Singh, 2011). Combining the profile matching method with other DSS method is also possible, like the DSS for military personnel assignment system that uses both AHP and two-sided matching (Korkmaz, et al., 2008).

According to the coach, during the selection process, all players are known to have good body postures. As Ubaya basketball team is notorious of its quick play, coach will search for players with great agility and speed for quick play tactics. Aside of these two criteria, coach also considers three more factors: technical, physical, and mental abilities. Extra point will be given for players with good attitude, which is observed both inside and outside play. The coach has his own standard for each position, related with the aforementioned criteria, which is shown on Table-1. These percentages are gathered from the selection process. This method is similar to another work on basketball statistics for player positions (Sampaio, et al., 2006), albeit the difference on percentages.

**Table-1. Player Scoring Standard for Each Position**

Position	Passing	Dribbling	2-pt Shoot	3-pt Shoot
Point Guard	75%	80%	70%	60%
Shooting Guard	70%	70%	75%	75%
Small Forward	65%	75%	70%	65%
Power Forward	N/A	N/A	70%	N/A
Center	N/A	N/A	65%	N/A

Passing is scored by requiring players to perform passing to predetermined directions. Players are scored based on how many times player can accurately perform passing. For example, if a player can pass 8 out of 10 tries, then his/her accuracy is 80%. Both 2-pt shoot and 3-pt shoot, as well as dribbling and free throw, are scored in such similar way. Players rebound are also included in the statistics. In the mental abilities criterion, we look at player statistics acquired from sparring matches. To determine the concentration value of a player, coach looks at player's turnover and personal fouls values. Players with low concentration will perform turnover and fouls more often. Bravery is usually scored by direct observation during matches, but is not included within sparring match statistics. The more a player is brave to penetrate into opponent's defense and/or decide to shoot in the remaining time during a match, the braver s/he is. Meanwhile, player's attitude is observed from his/her presence during exercise sessions. These mental abilities are usually used for decisive criterion when two or more players have the same statistics on technical and physical abilities during selection and sparring matches. In the other hand, physical abilities statistics are gathered from widely accepted standard tests, such as Illinois Agility Test for agility (Hachana, et al., 2013), Sargent Jump Test for strength (de Salles, et al., 2012),  $\dot{V}O_2max$  test for endurance (Castagna, et al., 2007), and so on.

After direct observation on Ubaya basketball team selection, we find that it is often difficult on determining the best players to form the main team. Irregular player performances, during exercises or matches, frequently baffle coaches to pick best players for each position for starting five for each match. The ever-changing statistics also slows down coaches when forming a skillful team in matches. Thus, coaches often take wrong decision, resulting in match losses. Therefore, we propose to create a DSS to help coaches formulate best decisions to form the main team.

We start the design by performing data design, using Entity-Relationship Diagram, as shown in Figure 1. This design is then mapped into MySQL database and tables. Some of important player statistics are recorded in `latih_tanding_pemain` table, with preselected important statistics (Kubatko, et al., 2007) as used in NBA (Anon., 2016) according to the coach's data. We also design the user interface, comprised into front-end and back-end, taking into account that end users (in this case, Ubaya coaches) may never use a Website before, so the DSS must be designed to be as user-friendly as possible. The DSS is implemented into a local Website. There are three kind of users according to access level: admin, coach, and player. Admin has full access to the Website. Coach has access to player presence recap, see player statistics reports, and use the DSS. Player only has access to player statistics report, including one's own and one's friends. The Website is then implemented using PHP and JavaScript.

When the development of this DSS is finished, we verify the system so that the DSS is free of fatal errors and perform the calculation correctly. As the system will be used by Ubaya coaches and assistants, the system is presented in Indonesian (Bahasa Indonesia), therefore the following figures will also be presented in Indonesian. However, we will

explain each figures for English readers. Some preliminary data gathered in the previous development phase are used. Coach can add new players as needed, by entering player's name, date and place of birth, height (in cm), gender, initial position, and picture. Player's picture is required as it will be displayed in the final result of the DSS (if chosen) to help coaches easily remember and recognize the player. The system will remind the user if any required data is not provided, as shown in Figure 2. In this figure, the admin is required to fill in (from top to bottom) player's name, date of birth, place of birth, height (in cm), gender, position, and player's photo. When place of birth is not specified and the form is submitted, the system will give a popup warning "Please fill in this field".

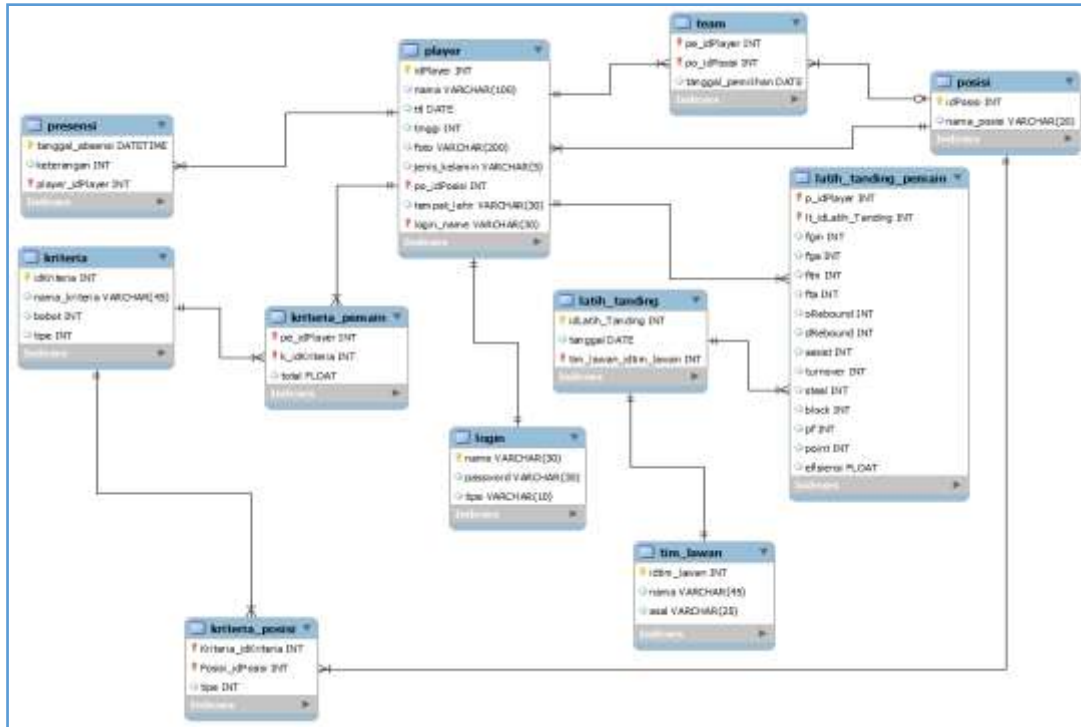


Figure 1. ER-D of the DSS

The screenshot shows the 'Tambah Pemain' form with the following fields and values:

- Nama**: test
- Tanggal Lahir**: hh/bb/TTTT
- Tempat Lahir**: (empty)
- Tinggi**: 185 (Warning: "Harap isi bidang ini.")
- Jenis Kelamin**: Putra
- Posisi**: Point Guard
- Foto**: (empty)

Buttons for 'Submit Button' and 'Reset Button' are visible at the bottom.

Figure 2. Add new player page

Before the DSS is ready to calculate the best players to fill in starting five positions, we need to provide some initial data, including players' presence on training sessions and players' statistics on sparring matches. For players' presence, the coach simply enters the date and time of training session, then tick on each player attending the training session. Players' statistics are input in a similar manner: firstly, coach adds a new sparring match, adding new opponent team if required; secondly, coach enters all players' statistics, including those who are not actually playing. Coach and admin may then look at presence and/or sparring match report when desired. Figure 3 shows an example of

players' statistics after a sparring match with UniversitasAirlangga.Coach or admin first picks the opponent team at the topmost dropdown menu (Tim Lawan), then records of players' performance is displayed, the first column (Nama Pemain) being the name of players participating in that sparring match. Only core statistics are displayed here, and it is assumed that the user is highly proficient with basketball statistics, so we do not feel the urge to give a brief explanation on the page.

### Laporan Statistik Pemain

Tabel Statistik

Tim Lawan:

Lawan tanding : Universitas Airlangga

Nama Pemain	FGM	FGA	FTM	FTA	O.REBOUND	D.REBOUND	ASSIST	TO	STEAL	BLOCK	FOUL	POINT
Antonius Rizal	2	6	1	2	1	3	1	1	1	1	1	6
Johanna Putri Susanto	1	3	1	2	0	1	2	1	1	0	0	3
Ardy Li	1	3	2	2	2	1	2	3	1	1	4	10
Yerikho Tusesela	1	11	4	4	3	5	2	2	1	1	1	16

Figure 3. Report page of players' statistics after a sparring match

### SPK Pemain

Tabel Pembagian Core Factor, Secondary Factor, dan Nilai Total Aspek

Perilaian Aspek Teknik

Nama Pemain	Core Factor	Secondary Factor	Nilai
Oteng Rodrundes	2.9	3.25	3.04
Fayiko Fransiskus Polar	2.8	3.5	3.08
Bryan Erhance	3.3	3.25	3.28
Ramadhananto	2.7	3.5	3.02
Antonius Rizal	2.7	3.5	3.02
Andjansa Sumitro	2.5	3.25	2.8
Yerikho Tusesela	3	3.5	3.2
Avin Saady	2.7	3.25	2.92






Figure 4. First step of profile matching method calculation

The DSS is now ready to suggest the team. When user chooses to run the DSS, one will be presented with additional input for criteria. User provides the importance of each factors for each position, with 5 signifies a very high importance and 1 denotes a very low importance. For the purpose of verification, only admins are able to see the calculation performed by profile matching method in great detail. For example, Figure 4 shows the first step of calculation for technical criterion, displaying the core factor and secondary factor values, as well as the total value for that criterion. Coaches will only see the final result, as revealed in Figure 5. This page shows the selected starting five players for men (first row) and women team (second row). The bottom buttons (from the leftmost to the right: GAP history, GAP conversion history, core and secondary factor history, calculation result history, and player rank history) are only visible to admins. When desired, coach can also look at each player's detailed scores (Figure ). Player's photo, name, and selected position is displayed at the top of the page. The following row shows the player's core statistics. The table in blue, red, and orange headers respectively explains the player's technical, mental, and physical aspect scores. Some aspects are labeled Very Good/SangatBaik, Good/Baik, Fair/Cukup, Low/Rendah, and Very Low/SangatRendah, while other aspects are not labeled because of coach subjectivity.






### SPK Pemain

Tabel Starting Five

Tabel Starting Five Putra

Point Guard	Shooting Guard	Small Forward	Power Forward	Center
				
Bryan Erhance	Yerikho Tusesela	Ardy Li	Yosua Butar Butar	Syahroni

Tabel Starting Five Putri

Point Guard	Shooting Guard	Small Forward	Power Forward	Center
				
Octaviana Stefani Rumenius	Hilda Rakaswi	Olivia Claudia	Stephanie Yolanda	Monica Kristantia Liem

Riwayat GAP Riwayat GAP Konversi Riwayat Core dan Secondary Riwayat Hasil Pembagian Riwayat Urutan Pemain

Figure 5. Suggested men and women team



Figure 6. Player's detailed scores

We then validate the DSS by asking two coaches and one assistant to use the system. Due to limited time constraint, we did not take into account the winning rate of the basketball team proposed by our DSS. Nevertheless, during the interview with Ubaya coaches and the assistant after using our system, all feel satisfied with the system, as the system can easily suggest the best players for each situation. It is also the nature of a DSS of not replacing the main decision maker, but instead enhance the decision making, thus it is possible that the proposed result from the system may not actually be used in the final decision. We also ask them to rank the system using a five-scale ranking (Very Satisfied, Satisfied, Ordinary, Dissatisfied, Very Dissatisfied) in terms of user interface/experience, ease of information gathering, completeness of information, clarity of presented data/information, DSS usefulness, and overall system, which are summarized in Table-2. Only one coach and the assistant were willing to rank the system.

Table-2. System Rank Evaluation according to Coach and Assistant (in %)

Indicator	Coach 1	Assistant	Average
User interface/experience	80%	80%	80%
Ease of information gathering	60%	80%	70%
Completeness of information	80%	60%	70%
Clarity of presented data/information	80%	80%	80%
DSS usefulness	100%	80%	90%
Overall system	80%	80%	80%

The same validation is conducted with basketball players. We randomly selected 20 players, then we ask them to use the system using player access level. Although players can only see each other's statistics reports, we observe that all players were excited to see their own statistics and compare it amongst themselves. This can be useful for players to motivate themselves on doing the very best, resulting in healthy competition and better overall team quality. After using the Website, players may opt to rank the system using a five-scale ranking (Very Satisfied, Satisfied, Ordinary, Dissatisfied, Very Dissatisfied) in terms of user interface/experience, completeness of information, clarity of presented data/information, and overall system. Only 14 players opted in to rank the system. The result of the ranking is presented in Table-3. Some players suggest better presentation of data/information, as they were overwhelmed with the abundance of information. Most players ask to add information about MVP (most-valuable person), however this is beyond the scope of our DSS.

Table-3. System Rank Evaluation according to players (in %)

Indicator	Average
User interface/experience	94%
Completeness of information	100%
Clarity of presented data/information	79%
Overall system	94%

## CONCLUSION

This DSS is helpful for Ubaya coaches to determine which players suitable to fill in the starting five positions to form the main basketball team for each matches, bases on available statistics and criteria. Players data gathering and

reporting is now easier thanks to the ease of use of the DSS. This includes players' presence for each training sessions, as well as players' statistics from each sparring matches. The availability of these reports for players enable players to encourage themselves to become best players, improving the total quality of the team. For future development on this system, we suggest to enable coaches add more criteria on player selection, as well as inclusion of different player statistics on the same sparring match. Another interest for future research is to compare the result of this DSS with actual decision of the coaches, and how the selected team perform in matches. It is also suggested to improve player's statistics page with better information presentation to help players better understand their performance and capability.

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