



## The Development of Android-based Score Sheet Application for the Referee (Chair Umpire) in Tennis Match

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### Abstract

This research is done based on problems that occur in tennis match because they still use manual Score Sheet, so researches interested in conducting research and development of an Android-based score sheet application for the referee (chair umpire). Development being done are the potential and problems, data collection, product design, design validation, design revision, free trial product, free trial usage. Data analysis using a quantitative and qualitative approach. The result of the research on the small scale product validation by tennis referee experts has obtained an average score of 4.5 with category of “very good” and IT experts obtained an average score of 4.2 with category of “good.” While on the validation of large scale product by referees was 4.8 with the category of “very good” and IT experts obtained an average score of 4.7 with the category of “very good.” The final product effectiveness test on a small scale trial was stated “very good” with a percentage of 81.72 % by the referee. While on the large scale trial obtained a percentage of 93.44% by the referee. The conclusions of this research were product development of Android-based score sheet application at tennis match greatly helped the referee’s performance in recording match statistics, Product development of Android-based score sheet application for the referee at tennis match was worthy of being used as mass products.

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## INTRODUCTION

Nowadays, sports have become part of everyone's needs in their daily activities. Everyone has their own goals in carrying out a sporting activity. Sports can be done as training, education, entertainment, recreation, achievement, profession, politics, business, industry, and various other aspects in human culture (Dartija, 2015). Achievement sport is a sport that is intended as an effort to increase the ability of sportsmen's potential to increase the dignity of Indonesian people. The progress of a country in the international world can be reflected in the sports achievements that have been achieved. According to Ahmadan, Nasuka, and Pramono (2018) a country which science and technology are developing rapidly, sports achievements tend to develop rapidly.

Science and Technology (IPTEK) currently have a very rapid development. According to Supegina, and Iklima (2015) technological developments change various sectors of life in the world that are present to facilitate human work in carrying out their daily activities. More advanced technology that is accompanied by the rapid development of knowledge creates creative and innovative works (Wicahyani, Handayani, and Hartono, 2018). The development of science and technology is very influential in political, economic, social, and cultural fields. Also, the development of science and technology has a large influence in the field of sports.

Science and technology are very influential in the field of sports. According to Fitriyanti (2016) science and technology which have progressed rapidly in this past few years have made people build various types of equipment as a tool in carrying out various activities to support their productivity. According to Candra, Setyawati, and Wahyu (2017) the progress of this science and technology helps a lot of human activities, especially in the field of sports both in various matters about training and also competitions and races. Technological developments in sports are very rapid, as evidenced by many changes from infrastructure,

information, competition systems, and refereeing.

Nowadays, a technology that is widely used by consumers is smartphones. Smartphones have various conveniences offered. According to Purwanto (2017) a smartphone or in Indonesian can be called a smartphone is the development of the previous handphone, which only has a few functions such as SMS or telephone. However, smartphones, for now, have several multifunctional advantages that can help human work and facilitate desired activities in one hand. According to Titting, Hidayah, and Pramono (2016) a smartphone is a device that makes it possible to communicate (call or SMS) but inside it also has the function of a PDA (Personal Digital Assistant) and has a capability like a computer. Currently, around 1.7 billion smartphones are used throughout the world, while the total of the world population is 6 billion (Wang, and Higgins, 2012). Smartphone users in Indonesia are also growing rapidly. The digital marketing research agency Emarketer estimates that in 2018 there will be more than 100 million active smartphone users in Indonesia. With this large amount, Indonesia will become the country with the fourth largest active smartphone users in the world after China, India, and America.

This smartphone is equipped with an operating system that supports the running of devices which are very popular and most chosen by users is the Android operating system. Operating System (OS) based Android operating system is an open platform so that it can be run on various Mobile and Internet Devices (MID). The popularity of this Android is due to openness and free development to produce many applications, as said by Ma, Gu, and Wang (2014) "*Now the Android system in the electronics market is becoming more and more popular, especially in the smartphone market. Because of the open source, some of the development tools are free, so there are plenty of applications generated.*"

The reason consumers have a smartphone is that a smartphone is easy to carry everywhere. Through an Android-based smartphone, everyone can have various interesting applications. This smartphone makes it easy for

humans in doing activities or daily needs by downloading the features needed.

One of the fastest-growing and popular sports today is tennis. Tennis match has several match officers who are competent in their duties. In general tournament rules, the committees or match technical officers consist of: (1) the tournament director, (2) the match supervisor, (3) the chief referee, (4) the referee/chair umpire, (5) the line judge/linesman, (6) the ball picker, (7) the number pointer, (8) the officer table, (9) the affairs of player health, (10) the affairs of equipment, (11) promotion, tickets, security, and general affairs. One of the important things in a tennis match that can't be left is the one who leads the match or usually calls as "the chair umpire."

A referee (chair umpire) has a very important role in a competition or sports game, especially sports which lead to achievement. Tennis has experienced the development of science and technology rapidly. According to Hadi (2018) in developing sports achievements, many things must be prepared to achieve the expected goals. The things that must be prepared, such as athletes, coaches, management, facilities and infrastructures, competitions, competition devices, and also other sport powers. A referee (chair umpire) is expected to carry out his functions correctly and adequately by always upholding justice and responsibility for the holding of the match. The supporting facilities and infrastructures of the referee's (chair umpire) duties are very necessary to facilitate the performance in leading a match by following technological development.

The referee (chair umpire) as the match leader in the field must have the equipment that supports his performance. The main equipment needed by a tennis referee (chair umpire) is a score sheet. There are several kinds of score sheets in a tennis match, including pro sets, the best of three, the best of five and others. The use of score sheet types is based on the tournament level and agreement. The score sheet is needed by the referee (chair umpire) as authentic data to make it easier to calculate scores in a match. From the score sheet, people can see the score and all events that occur during the match.

The national tennis match, especially the national tennis championship at the national level recognized by the referee (chair umpire) PELTI (2018) uses paper score sheets. The referee (chair umpire) manually fills out the score sheet with stationery. Based on the consideration in this digital era, the researcher wants to develop a score sheet application that makes the referee's (chair umpire) performance easier. This application will be based on Android, and the referee (chair umpire) can directly send the result of the match to the secretariat or report to the online referral team.

The problems that occur from the result of the preliminary research are the absence of a digital score sheet for TDP/national matches, the score sheet of the match result that has been reported to chief referred is not saved properly, and the report on match result is not quickly accepted.

The modification of score sheet as a means of refereeing is through an Android-based application. The reason for the researcher uses an Android-based sheet score is because now everyone has an Android-based smartphone. So, all referees (chair umpire) who are licensed at least provincial level can download the application using their smartphone, and the referees (chair umpire) will be given a username and password by the chief referrer so that the application can be used.

Based on this background, the researcher wants to research with the title "The Development of Android-Based Score Sheet Application for the Referee (chair umpire) in Tennis Match."

## **METHODS**

The type of this research is Research and Development (R & D). According to Sugiyono (2012) research and development is a research method used to produce certain products and test the effectiveness of these products. This research aims to develop an Android-based score sheet that is used to simplify how to fill it. The development procedure according to Borg, and Gall (1983) consists of two main objectives, they

are: (1) developing the product, and (2) testing the effectiveness of the product in achieving the goal. The procedures for development research carried out are (1) potential and problem, (2) data collection, (3) product design, (4) design validation, (5) design revision, (6) product trial, (7) usage trial. The data used in this research are qualitative data and quantitative data. Qualitative data is obtained from the interview in the form of criticism and suggestion from the referee experts and IT experts in the form of spoken and written as constructive input for product revision materials, and questionnaire data. Quantitative data is obtained from the results of product effectiveness research. The product effectiveness is analyzed by comparing nominal/numbered data so that the data analysis technique used is descriptive percentages to determine the product validity from the experts and the acceptance responses from the referees (chair umpire) toward Android-based score sheet applications for the tennis referees (chair umpire) through questionnaires given by the researcher. While the data in the form of suggestions and reasons for choosing the answers are analyzed using qualitative analysis techniques.

The trials are conducted to get responses and product revisions so that the final product will be produced in the form of an android score sheet application for the referees (chair umpire) in tennis matches. The research subjects conducted in this research are divided into two; the research in product trials and usage trials. In the product trials, the subjects of the research are five national referees in Central Java Province while in the usage trials, the subjects of this research are the national referees in Central Java Province. After testing the product, the product analysis and revision are carried out before using the trial. After testing the next stage of improvement, the final analysis and final revision will produce the final product ready to use.

The instruments used in product development were questionnaires and field observations when the research process was running. While the data collection techniques used in this research were using observation and documentation when the research process was

running. The data used in this research are qualitative data and quantitative data. Qualitative data is obtained from the interview in the form of criticism and suggestion from the referee experts and IT experts in the form of spoken and written as constructive input for product revision materials, and questionnaire data. Quantitative data is obtained from the results of product effectiveness research. The product effectiveness is analyzed by comparing nominal/numbered data so that the data analysis technique used is descriptive percentages to determine the product validity from the experts and the acceptance responses from the referees (chair umpire) toward Android-based score sheet applications for the tennis referees (chair umpire) through questionnaires given by the researcher. While the data in the form of suggestions and reasons for choosing the answers are analyzed using qualitative analysis techniques. The researcher analyzes the data through the following steps: (1) collecting data and observations, (2) conducting the first analysis, (3) conducting the second analysis, (4) conducting the synthesis process, (5) making conclusions. Then, the score obtained is converted to a value of scale 5, according to Suharyanto (2017).

**Table 1.** The Scoring Level

Score	Value	Category
$X > 4.21$	5	Very good
$3.40 > X > 4.21$	4	Good
$2.60 < X \leq 3.40$	3	Good enough
$1.79 < X \leq 2.60$	2	Less
$X \leq 1.79$	1	Very less

Suharyanto (2017)

The formula that is used in calculating the percentage is a follow:

$$P = \frac{\sum x_i}{\sum x_j} \times 100\%$$

- P = Percentage
- $\sum x_i$  = Total score of chair umpire
- $\sum x_j$  = Maximum total score
- 100% = Constant

From the results of the percentage obtained then it is classified to obtain data conclusions.

**Table 2.** Conversion of Assessments Based on Percentage

Percentage	Classification	Meaning
75 - 100	Very good	Very worthy
50 - 75	Good	Worthy
25 - 50	Less good	Evaluated
0 - 25	Bad	Unworthy

Sugiyono (2016)

## RESULTS AND DISCUSSION

The first step is to determine the product specifications to be developed. After determining the product development criteria for the Android-based score sheet application, the next step is to make the initial product through the design and production process. The initial product produced is the development of an android score sheet application for the referees (chair umpire) in tennis matches. In making the initial design, the researcher focused on the aspects of the criteria used by the Ministry of Youth in the 2010 selection of innovative sports technology competition on Soenyoto (2014). There are 6 aspects and criteria in developing android score sheet application for the referees (chair umpire) in tennis matches which are used as guidelines, they are: (1) originality aspects, (2) aspects of excellence, (3) usefulness aspects, (4) economic aspects, (5) effectiveness aspects, (6) completeness aspects. After the process of making design, then the initial product of the Android score sheet application was produced for the referees (chair umpire) in tennis matches. The following is the product icon or menu of the initial score sheet based on Android before being validated by the expert team includes the application icon, entry page, match configuration page, confirmation page, toss page, summary page, and in-game page.

### Validation of the Initial Product

The product of the development of an Android-based score sheet application before being tested on a small scale in a product trial research requires validation of the application by the experts first. Validation of the application involves four expert validators, namely two tennis referee experts and 2 IT experts. Validation was carried out by an expert team by observing

the product development of an Android-based score sheet application completed by an evaluation sheet, a suggestion, and input sheet.

### Data Description of the Initial Product Validation

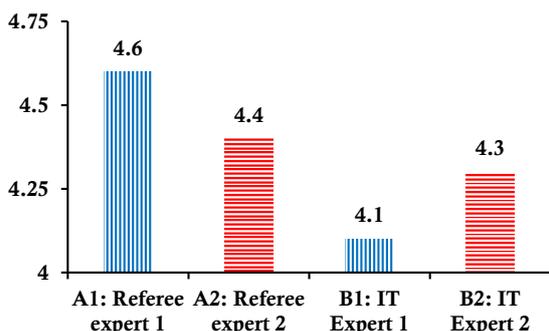
The data obtained from the initial product validation was carried out to the referee validators they were Mr. Yoyok Eko P (referee expert I) and Mr. Rivan Sagita P, S.Pd. M.Or (referee expert II) on December 12, 2018, in Semarang. The finding of the initial product validation by the referee expert 1 showed that the average score was 4 with “good” category while the result of the initial product validation by the referee expert 2 showed that the average score was 4.2 with “good” category. Product revisions are carried out before product testing or small-scale trial. Based on revisions and suggestions from the experts on the development of this Android-based score sheet application, the revisions were made.

**Table 3.** The Initial Product Revision

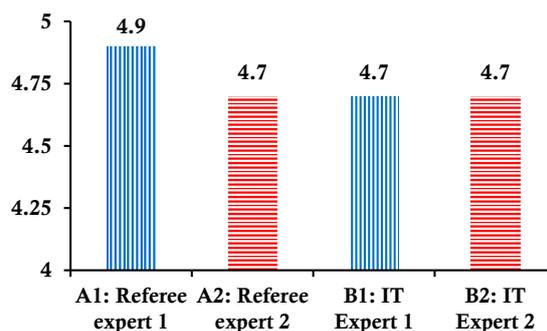
Revised part	Revised reason	Improvement suggestion
In game page	The undo feature is not functioning properly	The undo feature must be enabled and the replay feature removed

### Small-scale Trial

The first product trial was carried out in Semarang Tambora Tennis Court on elementary school POPDA Championship in 2019 with the referee (chair umpire) trial subject respondents. Based on the questionnaires, the result showed that the referee's responses toward the product were 81.72% with “very good” category, which was stated to be worthy of being used. Validation of the referee expert I (A<sub>1</sub>) showed that the average score was 4.6 with “very good” category while the validation of the referee expert II (A<sub>2</sub>) showed that the average score was 4.4 with “very good” category. Validation of IT expert I (B<sub>1</sub>) showed that the average score was 4.1 with “good” category while for IT expert II (B<sub>2</sub>) showed that the average score was 4.3 with “very good” category.



**Picture 1.** Diagram of The Small Scale Product Trial Validation



**Picture 2.** Diagram of The Large Scale Product Trial Validation

The followings are the suggestions and improvements after a small scale trial was carried out, those are: (1) on the in-game page, the pause feature is completed with the reasons, (2) the name of the application is replaced by the name of the researcher, (3) the logo and the word ITF on the printed paper replaced with the words which show the original made by the researcher, (4) completing and correcting the data in the match results printed, (5) on the summary page of the person, who chooses the place is clarified.

### Large-scale Trial

A large scale trial in this research was conducted on January 25-26, 2019, in Semarang Tambora Tennis on high school POPDA championship in Semarang City level in 2019. The number of respondents in this large scale trial was ten referees (chair umpire). Based on the questionnaires, the results showed that the referees' responses toward the product in the large-scale trial were 93.44% with the "very good" category which was stated to be worthy of being used. Validation of the referee expert I (A<sub>1</sub>) showed that the average score was 4.9 with "very good" category while the average score of the referee expert II (A<sub>2</sub>) was 4.7 with "very good" category. Meanwhile, validation of IT expert I (B<sub>1</sub>) showed that the average score was 4.7 with "very good" category while the average score of IT expert II (B<sub>2</sub>) was 4.7 with "very good" category.

Based on the steps of development research to produce the product that has been carried out, then the final product is obtained in the form of an Android score sheet application for the referees (chair umpire) in a tennis match. This Android-based score sheet application is connected to a special website that has been set up. This product displays the score during the match (live score), and the results of the match can also be directly printed.

The indicators of the success of this product are in the form of analysis from observations, questionnaires, and discussions with the expert validator teams, those are IT expert validators and the referee experts and questionnaires for respondents in the trial they are the referees. The trials or validations of the product that have been done are always equipped with documentation. According to the product trials that have been carried out, the results showed that the Android-based application score sheet product was worthy and able to be used as an application that helps the referees to record scores and events in a match and can be made into mass products.

The conclusion of the Android-based score sheet application development final products is very feasible to use and can be used as a mass product.

### CONCLUSION

Based on the findings and discussions in this research, it can be concluded that: (1) The product of development of an Android-based score sheet application for the referee (chair

umpire) in tennis match greatly helped the referees' performance in recording or filling athletes' identities, scores, and events during the match, (2) The product of development of an Android-based score sheet application was worthy of being used as a mass products.

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