

The Design of Web-Based Application System Shoe Size Selection Based On Anthropometric Foot Size

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Abstract: Shoes have become a necessity and a human lifestyle in keeping up with the times. The primary function of shoes is to protect the feet from various conditions. Shoe size is an important consideration for consumers when buying shoes. One of the consumer behaviors when choosing shoes is to wear these shoes before consumers buy shoes. When consumers come to the store, consumers can try all the shoe numbers that match their foot size. However, it is different when buying shoes through e-commerce, consumers cannot try to wear shoes themselves if they buy them online, this condition often causes the purchased shoes to have a size that does not fit the consumer's feet. This study will discuss how to design a web-based application system to make it easier for consumers to choose a shoe size that fits their feet when buying shoes through e-commerce. The method used in developing this web-based application is the Waterfall model, which comprises several stages, i.e. analysis, design, code, and testing. This study produces a web-based application that can help users determine shoe sizes when buying via e-commerce.

Keywords : Shoe size, E-commerce, Web-based application, Waterfall, and Usability testing

1. INTRODUCTION

Using internet media is exploding and is becoming the most important part of the economy and meeting human needs. The internet has become the primary media used by many people [1]. Effective use of Internet technology is considered a major determinant of competitive advantage, market penetration, innovation, technology transfer, and even management competency [2]. One use of internet media is in terms of E-commerce or online shopping. Online shopping has taken off as an increasing number of consumers purchase diversified products on the Internet [3]. E-commerce success may be more a function of customers' belief and perception of the net value of the benefits and costs of both a product and the processes of finding, ordering, and receiving it [4]. E-commerce has internationalized, and buying products online across national borders has become straightforward and convenient for consumers, providing new business opportunities for both domestic and international online stores [5].

In recent years, the demands of online shopping for fashion items are increasing, and are predicted to increase in the future [6]. One activity found in online shopping is shopping for shoes. The consumer behavior when choosing shoes is to wear the shoes themselves before the consumers buy shoes [7]. By trying to wear them first, consumers will feel satisfied when buying shoes, this is done to find out whether the selected shoes fit their feet [8]. Recent studies show size and fit are among the most influential factors, driving e-commerce

customer satisfaction [9]. A crucial difference when engaging online compared to traditional brick and mortar retail is the lack of immediate sensory feedback about the fit and feel of a product [10]. One of them is information about shoe size. Because consumers cannot try to wear their shoes if they buy them online, this condition often results in the shoes they choose and buy, having a size that doesn't fit their feet [11]. This can lead to consumers choosing the wrong number and size of shoes when shopping online.

Regarding the problem above, one solution to solving the problem above is by creating a web-based application where consumers can determine the number and size of their shoes based on their anthropometric foot size. Web-based applications were chosen because, in their use, web-based applications are easy to access, open the website link without the need to install applications, easy server setup, and information is easy to distribute. In using this application, users will first choose the type of shoe for children, men, or women so that users can choose the shoe brand according to the user's wishes. Then input the calculated foot size manually as done by Bata [12], so the system will display the calculation result as shoe size according to the selected brand.

2. METHOD

A web-based application developed using the waterfall system development life cycle (SDLC) model with the following stages [13]:

i. System requirement analysis

Is a description of the behavior of the system to be developed. It collects system requirements, analyzes them, and then the proper documentation is prepared, which helps further in the development process.

ii. Design

The information gathered from the previous stage is evaluated and it plans an appropriate implementation. It is a planning and problem-solving process for software solutions. It deals with the selection of a suitable algorithm design, software architecture design, conceptual database schema, logical diagram design, and data structure definition [14,15].

iii. Coding

Applications will be created by translating the design that has been made into a language that is understandable to the computer.

iv. Testing

This phase deals with the real testing and checking of the web-based application solutions that have been developed to meet the original requirements. Also, it is the phase where the bugs and find outages in the system, fixed up, and refined.

v. Deployment/verification

The last stage is the application and verification of software [16, 17]. This stage is the application and verification by users related to the suitability of the needs with the development application features that have been made.

3. RESULTS AND DISCUSSION

First stage, it carries the system requirements analysis process out. With buying shoes through online shopping, it is difficult for people to determine the size and number of shoes that fit their feet. So we need a system that can make it easier for consumers to determine the size and number of shoes that match their feet. In making this web-based application, the system requirements needed are:

i. Shoe size data and foot anthropometric measurements

The data required in this research is shoe size data, along with the anthropometric dimensions of the foot for each number and shoe size. For research and testing, which will be used as a reference for a shoe size is research data from GF Waluyono, B. Suhardi, and E. Pujiyanto in 2019 [18] and research data from Waluyono in 2020 [19], that is shoe size data for children ages 4-6 years. The shoe size data used as the output of this web-based application is data on children's shoe sizes and foot lengths from several brands in Indonesia.

ii. Tools used

Several tools are used to develop web-based applications in this study, are XAMPP as a database server, MySQL database, PhpMyAdmin as a database manager, sublime text 3 is used for the text editor, bootstrap 5 as a framework, and Google chrome, is used for web browsing and debugging.

iii. Actor identification

Actor identification is a stage to distinguish between actor actions and system responses [20]. In this application, there is one actor in the system as described in table 1.

Table 1. Actor Identification

Actor	Description
User	Play a role in the system's operation and functions in the application

iv. Functional requirement

Functional requirements, which are the services that the system should provide to its end users [21].

Table 2. Functional Requirement Analysis

Functional requirement	Use Case name
The system can display a menu of shoe types	Choose the type of shoe
The system can display the brand selection menu	Appear shoe brand
The system can receive input, as foot size	Input foot size
The system can display the shoe size results after inputting the foot size	Show shoe size

v. Non-functional requirements

Non-functional requirements are a need that is not requested by users but is very much needed. Non-functional requirements (NFRs) constrain the behavior and development of a software system as they specify overall qualities or attributes the resulting system should have [22].

Table 3. Non-Functional Requirement Analysis

Parameter	Description of requirements
Compatibility [23]	Applications must be able to run on a personal computer or smartphone
Usability [24]	Applications must be easily used by users with usability principles, such as learnability, efficiency, memorability, errors, and satisfaction
Performance [25]	The system can display various shoe sizes

Then the design stage, it makes a flowchart consists of the use of web-based applications, state transition diagrams (STD), use case diagrams, creating databases, and designing the interface.

i. Flowchart

The following is a flowchart when the user applies the system that has been created.

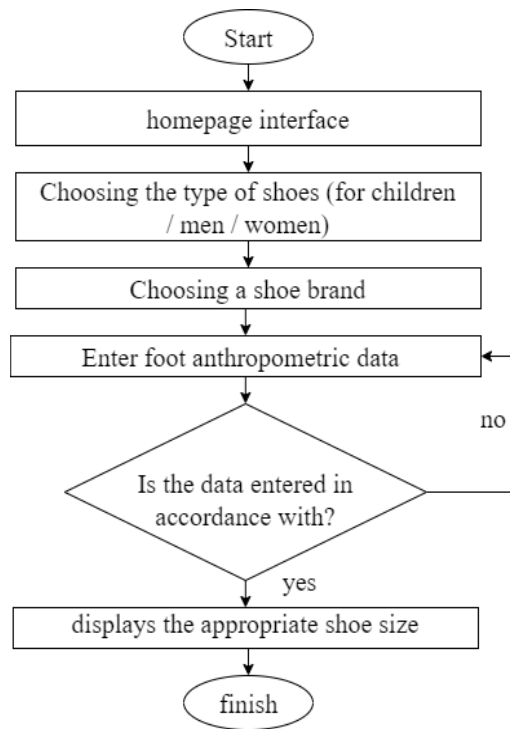


Image 1. Web-based Application Usage Flowchart

ii. State transition diagram (STD)

The state transition diagram represents the model of the system, including the state and transitions such as events and actions [26]. In this web-based application, STD is used to describe moving between application pages.

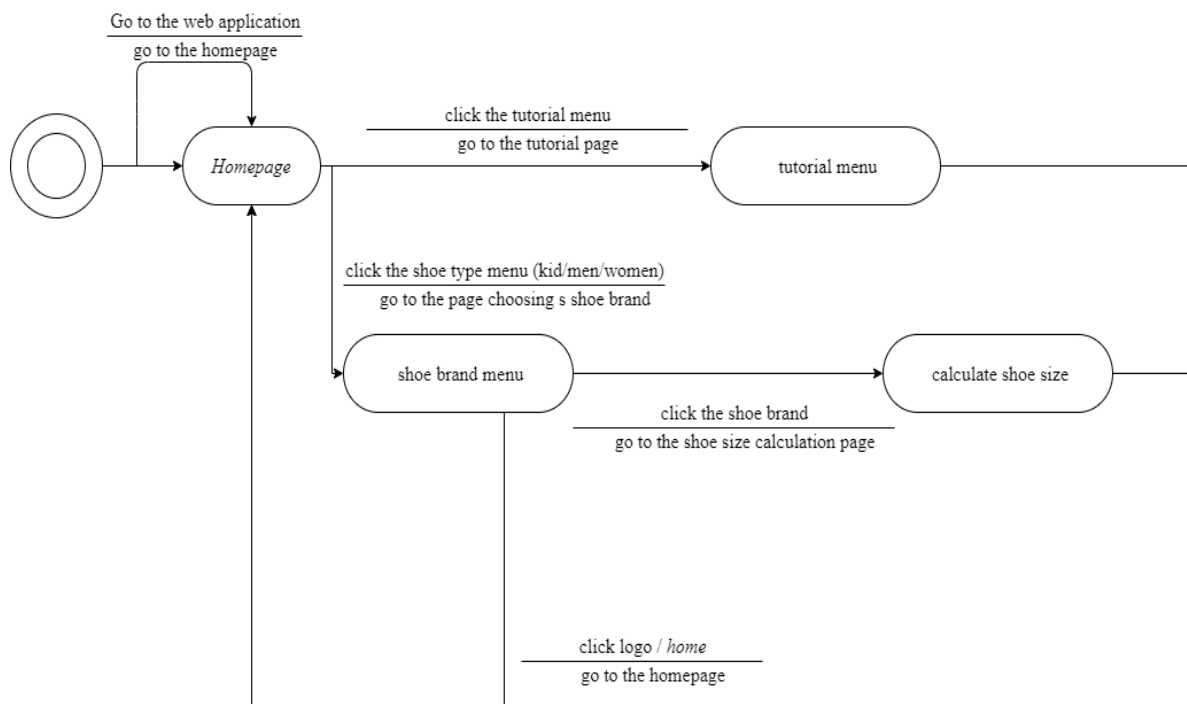


Image 2. State Transition Diagram

iii. Use case diagram

Use Case Diagram (UCD) is an essential artefact in systems functional requirements analysis and specification [27]. In this research, use case diagrams describe the functional needs of the user with the system to be built.

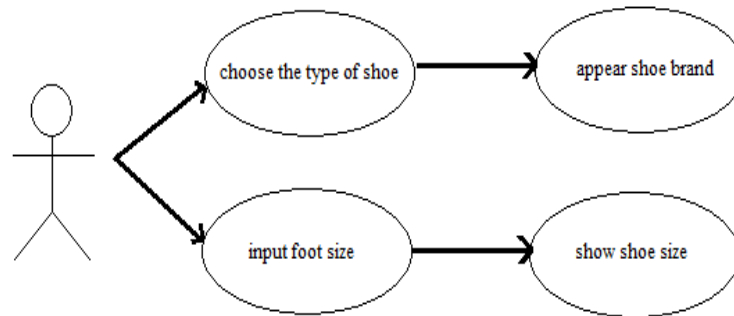


Image 3. Use Case Diagram

iv. Creating a database

At this design stage, entering existing foot anthropometric data and shoe sizes into the MySQL database using the open-source application, PHPMyAdmin. This application is used because it is easier to create databases, create tables, insert, delete and update data without the need to type SQL commands manually.

v. Designing the interface

At this stage, the user interface design of the web-based application will be designed.

Next, It will make applications using the HTML and PHP programming languages with the Sublime Text 3 framework to translate the designs that have been made into a language that is understandable to the computer. For making application interfaces, it is designed using the HTML, PHP and CSS programming languages and the Bootstrap 5 framework. The following is a view of a web-based application used to determine shoe sizes.

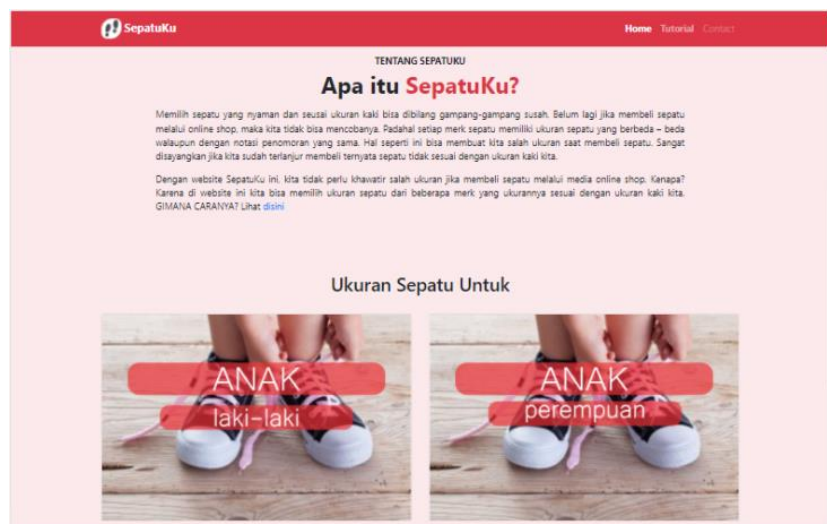


Image 4. The Homepage Interface



Image 5. The Tutorial Interface

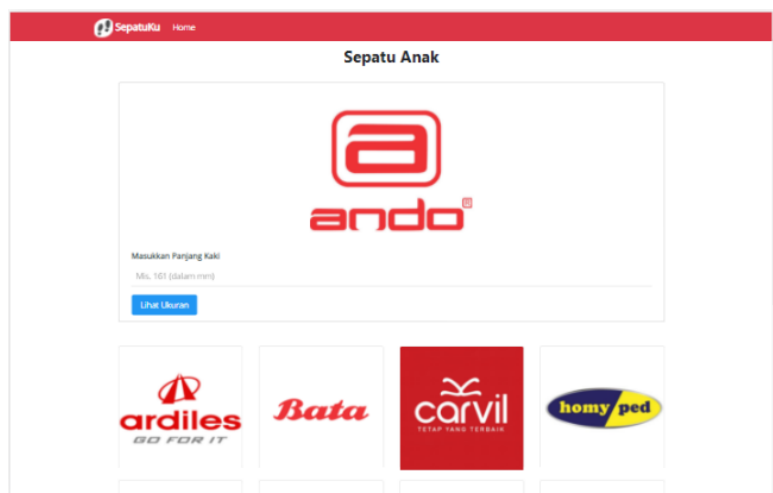


Image 6. Interface to Determine the Size of Kid's Shoes

The next stage is to test the web-based application design to find out whether the web-based application that has been created can be used as intended. It carries testing out using the black box method. Black box testing method is a method of testing that deals with unknown internal outcomes [28], where testing is based on functionality, to see if the program has been successfully executed. In testing this web-based application, the browser used is Google chrome.

Table 4. Web-Based System Application Testing

No.	Testing	Scenarios	Indicators	Status
1	Homepage	It can to display the homepage	If it can enter the homepage	Success
2	Tutorial page	It can to display the tutorial page	If it can enter the tutorial page	Success
3	Shoe selection page	It can to display shoe selection page by brand	If it can to display selection page according to brand	Success
4	Brand selection	Can choose shoes according to brand	If it can to choose shoes according to brand	Success
5	Show shoe size	1. It can to input foot size 2. It can display shoe size result	If it can to display shoe size according to data entered	Success

Based on the test results, it is known that all menus or functions of the web-based application have been running.

Next stage is verification, a web-based application is tested for the user, i.e. parents having children aged 4-6 years. It divides this testing phase into 2, system testing and usability testing.

i. System testing

This test is carried out to determine whether the system created can be used by inputting the user's foot size data and being able to display the results of the shoe size. It carried this test out by 8 users, i.e. parents who have children aged 4-6 years. Foot size data was tested on 11 shoe brands, and the tested children's feet were included in the small, medium, or large cluster based on research by Waluyono et al. in 2019 [18] and Waluyono in 2020 [19].

Table 5. Test Result

F.L. (mm)	F.W. (mm)	F.C. (mm)	Age	gender	Shoe size for the brand											Cluster
					1	2	3	4	5	6	7	8	9	10	11	
173	75	174	4	M	28	28	28	-	28	29	28	28	26	26	28	Narrow
208	85	205	6	M	33	34	34	32	33	34	31	32	32	32	33	Wide
205	86	213	6	M	32	33.5	34	29	32	33	31	31	31	31	32	Wide
188	77	193	5	M	30	31.5	31	29	30	31	28	28	29	29	29	Medium
178	80	180	5	M	29	29	29	-	29	30	28	28	27	27	28	Medium
172	65	190	5	F	28	28	28	-	28	29	28	28	26	26	28	Medium
196	84	200	6	F	31	33	33	30	31	32	30	30	30	30	31	Wide
168	70	175	5	F	28	27	28	-	28	28	-	-	26	26	-	Narrow

Two children are included in the small-foot cluster (narrow), three children are included in the large-foot cluster (wide), and three children are included in the medium-sized foot cluster (medium). Some of the shoe brands do not have shoes with children's feet that are included in the small cluster.

ii. Usability testing

Usability testing is used to measure the level of satisfaction of users when using the new system [29]. Usability is a quality attribute measuring the extent of simplicity in the interface usages [30]. This test involved 8 respondents, from parents who had tested the system using a web-based application and saw the results of shoe sizes. The number of respondents involved is as many as eight people, so that the usability problems found are not too large. In flow of this test, the respondents carried out activities from calculating the foot anthropometry of children's and opening the web-based application that had been made.

After experimenting, the respondent will fill in the answers of 5 questions representing 5 aspects of the usability test [31], i.e. learnability, efficiency, memorability, errors, and satisfaction. The assessment mechanism is by checking the box for each aspect with the following scoring criteria:

- 1. very less score = 1
- 2. less score = 2
- 3. Enough score = 3
- 4. well score = 4
- 5. Very good score = 5

Table 6. The Result of Usability Testing

resp	Question																									Total Score
	learnability					efficiency					memorability					errors					satisfaction					
	Q.1	Q.2	Q.3	Q.4	Q.5	Q.1	Q.2	Q.3	Q.4	Q.5	Q.1	Q.2	Q.3	Q.4	Q.5	Q.1	Q.2	Q.3	Q.4	Q.5	Q.1	Q.2	Q.3	Q.4	Q.5	
1	5	4	5	3	4	4	4	4	3	3	3	4	4	3	4	3	2	2	1	2	5	5	5	5	5	92
2	3	2	2	2	2	2	2	3	4	4	2	2	4	3	4	4	3	3	2	2	4	4	4	2	5	74
3	3	4	4	4	3	3	4	4	4	3	3	4	4	3	3	3	3	2	2	2	4	4	4	2	5	84
4	4	4	5	4	3	4	4	4	5	4	4	4	3	4	4	4	3	3	3	2	5	5	5	5	5	100
5	4	5	5	3	4	4	4	4	4	3	3	3	3	3	3	3	2	2	1	2	5	5	5	5	5	90
6	1	3	2	4	3	1	1	3	2	4	4	4	4	4	2	3	2	2	2	3	4	4	4	4	5	75
7	5	5	5	5	4	5	4	5	5	5	5	4	5	5	5	4	3	3	3	4	5	4	5	5	5	113
8	3	5	4	4	3	5	4	4	4	4	4	4	3	3	4	3	2	3	2	2	5	4	4	5	5	93
Jumlah																									721	

After getting the total value, then the calculation of the score is calculated according to the formula (1) as follows [32]:

$$\sum y = (\gamma \times n) \times 2.5 \dots\dots\dots(1)$$

Where $\sum y$ is the total score of the respondents, γ is the score of the respondents, n is the number of respondents, and 2.5 is the variable usability scale system. From the calculation of the score according to formula (1), the total score of the respondents is 1802.5.

Next, calculate the percentage of feasibility according to formula (3) [32]. Before calculating the percentage of feasibility, first the ideal score is calculated. It gets the ideal score from formula (2), as follows [32]:

$$\text{ideal score} = \sum \text{respondent} \times \sum \text{question} \times \text{highest score criteria} \times 2.5 \dots\dots\dots(2)$$

$$\text{percentage of feasibility} = (\sum y) / (\text{ideal score}) \times 100\% \dots\dots\dots(3)$$

The ideal score for the usability test for this web-based application is 2500. After getting the value of the ideal score, the percentage of feasibility is calculated. Based on the calculation of the percentage of feasibility, the percentage was 72.1%. So, the web-based application that was built is included in the feasible category according to the feasibility category table [33] with a value range of 61% - 80%.

4. CONCLUSION

Web-based application design that can be used on personal computers or smartphones to determine shoe size when buying shoes online can be built using the Waterfall application development method. From the results of the tests that have been carried out, it is known that the system can display the results of the foot anthropometric input as a shoe size. In the usability test, the feasibility percentage is 72.1% which shows that the web application is in the feasible category.

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