LONTAR KOMPUTER VOL. 13, NO. 2 AUGUST 2022 **p-ISSN 2088-1541**
DOI : 10.24843/LKJITI.2022.v13.i02.p05 **e-ISSN 2541-5832**
Accredited Sinta 2 by RISTEKDIKTI Decree No. 158/E/KPT/2021

Implementation Of Tree Model In The Development Of E-Mantram Android Application

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Abstract

Hindu Mantram is chants of speech with supernatural powers, which should not be done carelessly. The Balinese Hindu Mantram is a modified form of the Hindu Mantram that adapts to the local wisdom of the Balinese Hindu Community. The problem is that there is no digital education platform regarding the Balinese Hindu Mantram. Based on these problems, a mobile-based information system was built that integrates the Balinese Hindu Mantram and Yadnya Ceremony with its ceremonial procession. This information system applied Model Tree and UAT with PSSUQ Method. This research aimed to develop an application that can be a platform to provide education about the Balinese Hindu Mantram and its relationships. The results obtained from this research were the E-Mantram Android mobile application that implemented the Tree Model and UAT results with a System Usefulness value of 1.94, Information Quality of 2.06, Interface Quality of 2.06, and Overall of 2.01.

Keywords: *Android, Balinese Hindu Mantram, Mobile, PSSUQ, Tree Model*

1. Introduction

Balinese Hindu Mantram is chants of speech that have supernatural powers. Mantram are sacred, so often cannot be recited by just anyone [1]–[3]. The Balinese Hindu Mantram is a modified form of the Hindu Mantram that adapts the use of language and pronunciation with the local wisdom of the Balinese Hindu Community [2]. The problem being faced by local wisdom, such as mantram, is the erosion of knowledge about mantram amid rapid technological advances. In addition, the reduced interest of the younger generation in seeking knowledge about mantram and their use in *Yadnya* ceremonies and its processes [2], [4]. This is due to the limited number of digital educational platforms that facilitate education about mantram and their use in *Yadnya* Ceremonies and their processes. In addition, most knowledge about mantram is stored in a less up-to-date and interactive form [5]–[7]. Local wisdom has an essential meaning for our generation because it is a reflection of the uniqueness of the diverse cultures that exist in Indonesia [8]–[10]. Thus, local wisdom should introduce aggressively in the media world, which is currently so fast and open [11], [12].

Applications developed using the Android Platform with Tree Model implementation. The mobile development base was chosen because most people access information through smartphones. According to data from the Ministry of Communication and Information, smartphone users in Indonesia reached 167 million people, or 89% of the total population Tree Model is a data classification method that forms a tree or pattern with links to each data or entity [13], [14]. Another definition of the Tree Method is one of many non-linear data structure forms that visualize hierarchical relationships between elements in the form of tree structures [15], [16]. The tree Model was chosen because it is commonly used to describe the relationship between entities [14], [17]. An example of the relationship between entities in the E-Mantram Application is illustrated by the relationship between the Ceremonial Procession in the *Pitra Yadnya* Ceremony

and the *Pitra Yadnya* Mantram, where the *Pitra Yadnya* Ceremony Procession Entity is a child of the Ceremonial Entity. At the same time, the *Pitra Yadnya* Mantram Entity is a child of the Balinese Hindu Mantram. UAT testing on the E-Mantram application will use the PSSUQ Method. Post-Study System Usability Questionnaire (PSSUQ) is a questionnaire method consisting of 16 standard questions to measure the level of end-user satisfaction with a system or application and focuses on the information quality of a system or application [18], [19]. This survey method is platform agnostic. The PSSUQ questionnaire can be applied to any system or application without being limited by the technology or platform used. The PSSUQ questionnaire can also be used to measure the usability of a system or application [20]. The research aims to contribute to technology implementation in preserving local wisdom in the form of the Balinese Hindu Mantram by applying commonly known technology and research methods.

Previous research that implemented the Tree Model was taken from the *Lontar* Computer Journal, which discussed the development of a web-based *Bebayuhan Oton* Information System with the application of Tree Diagrams in system development. *Bebayuhan Oton* is a ritual believed by Hindus in Bali to neutralize the negative effects of the year of birth. This ritual uses a ritual means called offerings (*Banten*). The problems were the difficulty of making an appointment with *Sulinggih* and the lack of knowledge about the *Bayuh Oton* Ceremony. Based on the issues above, an application was required, so it was easier to find information related to the *Bayuh Oton* Ceremony and serves as a guide for its implementation. The *Bebayuhan Oton* Information System was developed to make information about *Bayuh Oton* available to the Hindu community. The modeling system used was a Tree Diagram to connect the *Bebayuhan Oton* Procession with the offerings and the required facilities. The system displayed the date of the procession, offerings, and equipment to complete the *Bebayuhan Oton* Ceremony [14].

Previous research that implemented the Tree Model from the International Journal of Interactive Mobile Technologies discussed the development of traditional Balinese snack recipe applications by applying the Tree Model and Recursive Algorithm. The background of this research was the difficulty of obtaining information about traditional Balinese snack dough. It caused the Hindu community in Bali not to know the importance of the role of traditional snacks in the *Yadnya* Ceremony. The implementation of the Tree Structure in compiling information on traditional Balinese snacks based on the Android Platform allowed users to find out the relationship between snack dough. Other support algorithms, such as the Recursive Algorithm, were used to make it easier to calculate the amount of dough displayed in the application. The research results were in the form of an application that helps the Hindu community in Bali more easily understand and find out information about traditional Balinese snack dough [21].

The research results were an Android-based information system with a mobile platform that provides information about the Balinese Hindu Mantram and its relation to the *Yadnya* Ceremony and its process by implementing the Tree Model in its development. In addition, the UAT testing results of the E-Mantram application with the PSSUQ Method.

2. Research Methods

This chapter discussed the stages and methods of the research carried out. The following were research methods that discuss the development of the E-Mantram Application.

2.1. System Overview

The design of the E-Mantram application started by designing an overview and context diagram. The application overview provided a global overview of how the application runs in general in the form of images that represent the application flow [22], [23], and context diagrams were simple diagrams used to show the relationship between entities, system inputs, and system outputs [24]. Context diagrams were created to represent the overall interaction of the system. An overview of the E-Mantram Application can be seen in Figure 1.

p-ISSN 2088-1541
e-ISSN 2541-5832

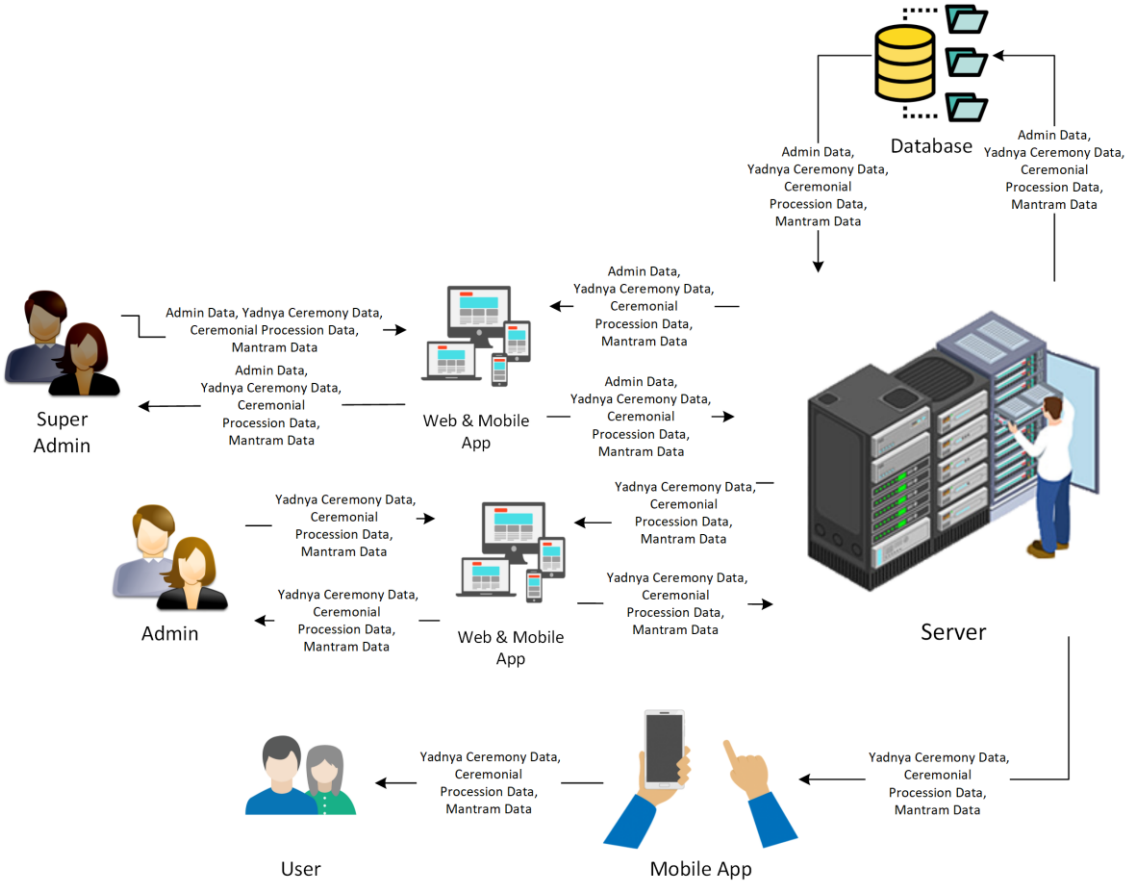


Figure 1. E-Mantram Application Overview

Figure 1 is an overview of the E-Mantram Application. It provided an overview of the general application usage flow of the E-Mantram Application. Overview of the E-Mantram Application also provided visual information about how the application works technically. It started from requesting data from the user to the server, then providing output data as requested by the user, data management by super admins and admins, etc. The next application design stage was to design a context diagram of the E-Mantram Application. The context diagram of the E-Mantram Application consisted of four entities, which can be seen in Figure 2.

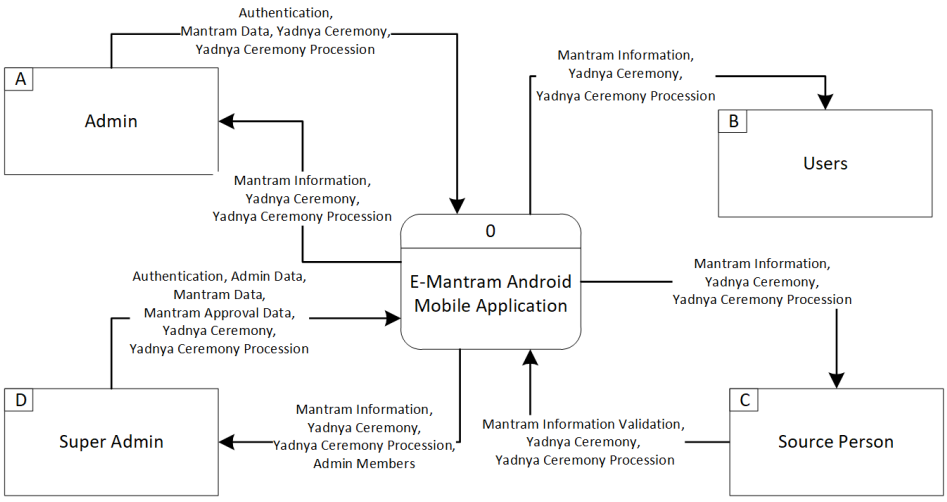


Figure 2. E-Mantram Application Context Diagram

Figure 2 is a context diagram of the E-Mantram Application. The context diagram of the E-Mantram Application showed that four entities were involved in the application, namely the super admin, admin, user, and source person entity. The context diagram of the E-Mantram Application provided a visual explanation of the role of each entity in the application.

2.2. Use Case Diagram

Use case diagram is a diagram used to describe the relationship between the system and users [25], [26]. It could visually explain the interaction between the system and users [25]. The use case diagram of the E-Mantram application can be seen in Figure 3.

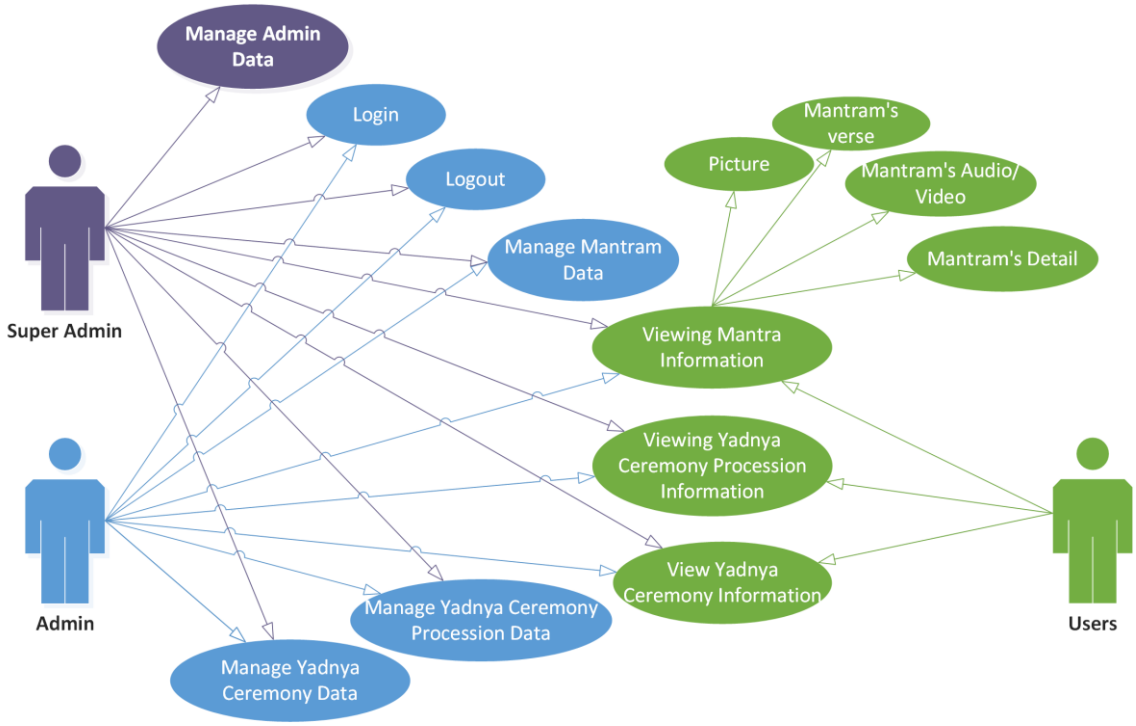


Figure 3. Use Case Diagram of the E-Mantram Application

Figure 3 is a use case diagram of the E-Mantram Application. The use case diagram of the E-Mantram Application showed three entities: super admin, admin, and user. Super admin entities could log in and log out from the application and manage Admin Data, Balinese Hindu Mantram Data, Ceremonial Procession Data, and *Yadnya* Ceremony Data. Super admins could also view Balinese Hindu Mantra Information, Ceremonial Procession Information, and Yadnya Ceremony Information. Admin entities could log in and log out from the application and manage Balinese Hindu Mantram Data, Ceremony Procession Data, and *Yadnya* Ceremony Data. Admin could also view Balinese Hindu Mantram Information, Ceremonial Processions Information, and *Yadnya* Ceremonies Information. User Entities could view Balinese Hindu Mantram Information, Ceremonial Procession Information, and *Yadnya* Ceremony Information from Balinese Hindu Mantram Data, Ceremonial Procession Data, and *Yadnya* Ceremony Data which super admins and admins had managed.

2.3. Data Flow Diagram

The data flow diagram is a diagram used to describe the flow of a system [24], [27]. Data flow diagrams generally started from level 0, then level 1, and so on [28]. DFD level 0 of the E-Mantram Application can be seen in Figure 4.

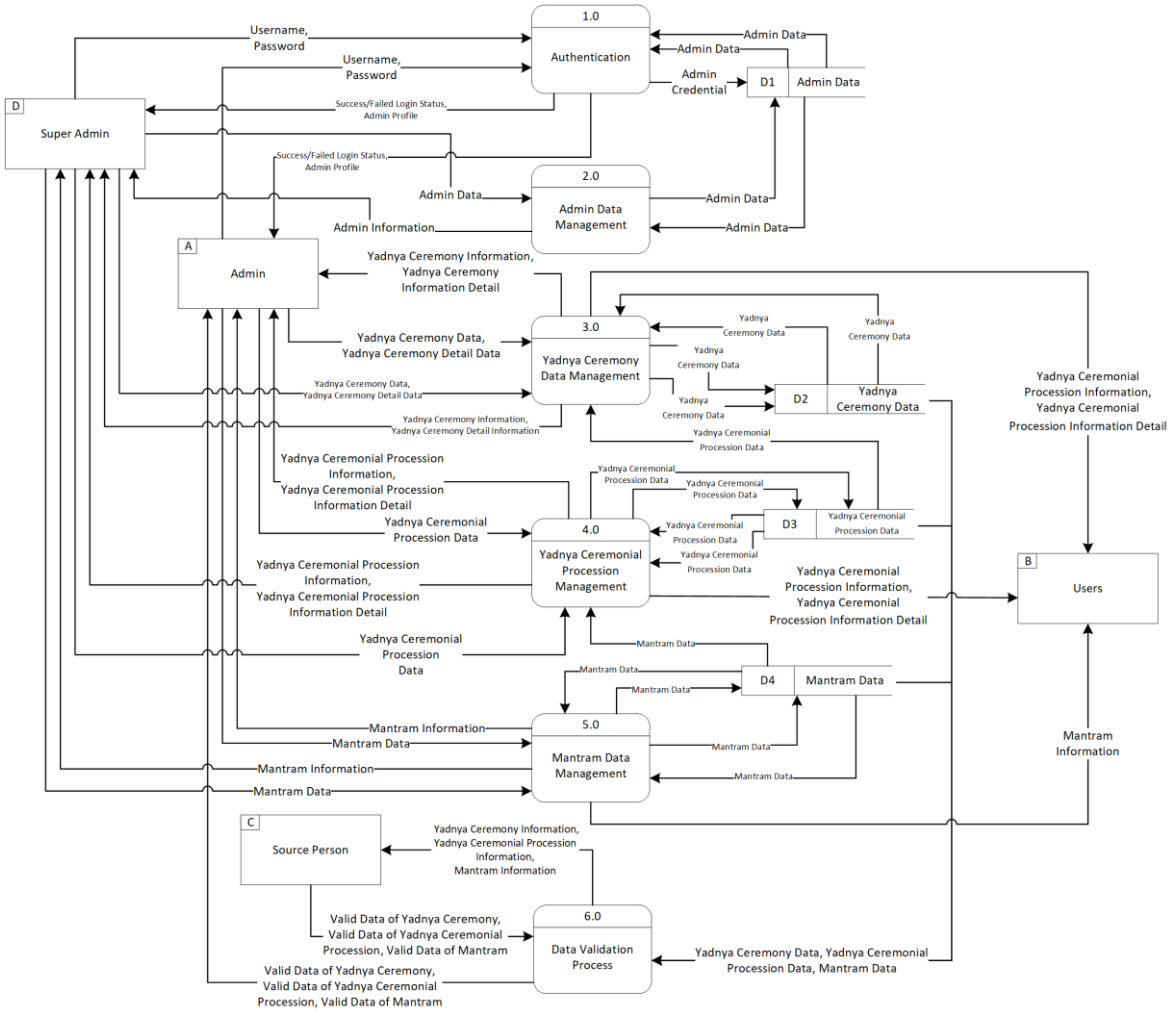


Figure 4. Data Flow Diagram Level 0 of E-Mantram Application

Figure 4 is a level 0 DFD of the E-Mantram Application. DFD level 0 of the E-Mantram Application shows six main modules: Authentication Module, Admin Data Management Module, *Yadnya* Ceremony Data Management Module, *Yadnya* Ceremony Procession Data Management Module, Mantram Data Management Module, and Data Validation Process Module. All processes were described visually through DFD level 0 of the E-Mantram Application.

2.4. Tree Model

A tree Model is a data classification model that forms a tree-like structure or data mapping method with links to each data [13]. Another definition of a Tree Model is a non-linear data structure form that displays a hierarchical relationship between one entity and another as a tree-like structure. The tree Model is one method that graphically represents a hierarchical structure (one to many) similar to a tree, even though the tree looks like a top-down node collection [13]. The tree Method can also be concluded as node collection with certain elements called roots and other elements called nodes divided into sets that have no relationship with each other (sub-tree) [4], [14].

2.5. User Acceptance Test (UAT)

User Acceptance Testing is a series of tests to assess whether the application meets user needs or not. User Acceptance Test is generally carried out before the application launch or the release of new features in the application. The expected result of the UAT implementation was that developers could understand whether the application had met user expectations or not [29].

2.6. Post-Study System Usability Questionnaire (PSSUQ)

Post-Study System Usability Questionnaire (PSSUQ) is a method consisting of 16 standard questions to measure the level of end-user satisfaction with a system or application and focuses on the information quality of a system or application [18]. This survey method was platform agnostic. It means that the PSSUQ questionnaire could be applied to any system or application without being limited by the technology or platform used. This questionnaire could also be used to measure the usability of a system or application [20]. PSSUQ also had an assessment norm that could be used as a reference for comparing results obtained from the calculation of the PSSUQ questionnaire. The assessment norms of PSSUQ version 3 can be seen in Table 1.

Table 1. Assessment Norms Table from PSSUQ Version 3

Sub-Scale	Lower Limit	*Mean*	Upper Limit
SYSUSE	2.79	3.02	3.24
INFOQUAL	2.28	2.49	2.71
INTERQUAL	2.62	2.82	3.02
OVERALL	2.57	2.80	3.02

Table 1 is an assessment norm table from PSSUQ version 3. The table above showed that each subscale had a lower limit, mean, and upper limit norm in the assessment norm of PSSUQ version 3. The assessment norm in the table above was used to compare the results obtained from the calculation of the PSSUQ questionnaire. The closer to or lower the assessment norm's lower limit, the better the calculation results obtained.

3. Result and Discussion

This section discusses the results and discussion of the research conducted. The following are the results and discussion of the research that discusses the E-Mantram Application development.

3.1. Tree Model Implementation

Tree Model implementation in this research aimed to help describe entity relationships between *Yadnya* Ceremonies, Ceremonial Processions, and Balinese Hindu Mantram. The description of the entity relationship between the *Yadnya* Ceremony, Ceremonial Procession, and Balinese Hindu Mantram will later be used as a reference for designing how the application displays the *Yadnya* Ceremony, Ceremonial Procession, and Balinese Hindu Mantram data. Also, along with the details and the relationships owned by each entity. Tree Model implementation in the E-Mantram Application can be seen in Figure 5.

Figure 5 is the Tree Model implementation in the E-Mantram Application. It was used to help describe the relationship formed between the Balinese Hindu Mantram and the *Yadnya* Ceremony and its procession. The data processed using the Tree Model had a JSON format stored in the MySQL database. The Tree Model was used to make it easier to describe the relationship between data by providing an overview of the parent-to-child relationship in each data. The classification was done by looking at each relationship in each data. Then, mapping between relations was carried out from these relations to produce a visualization shaped like a tree. The *Yadnya* Ceremony data used as an implementation example was the *Atma Wedana* Ceremony data. The *Atma Wedana* ceremony is related to processions, such as *Pemangku* Preparation (initial procession), *Pengaskaran* (peak procession), and *Matur Sembah* (final procession). Further, each procession is related to several entities, such as Balinese Gamelan, Balinese Dance, Balinese Song, Balinese *Tabuh*, and Balinese Hindu Mantram (The *Kramaning Sembah Mantram* is related to the *Matur Sembah* procession, the *Ngarga Tirta* Mantram is related to the *Pengaskaran* procession, and the *Ngaskara Genta* Mantram is related to the *Pemangku* Preparation procession).

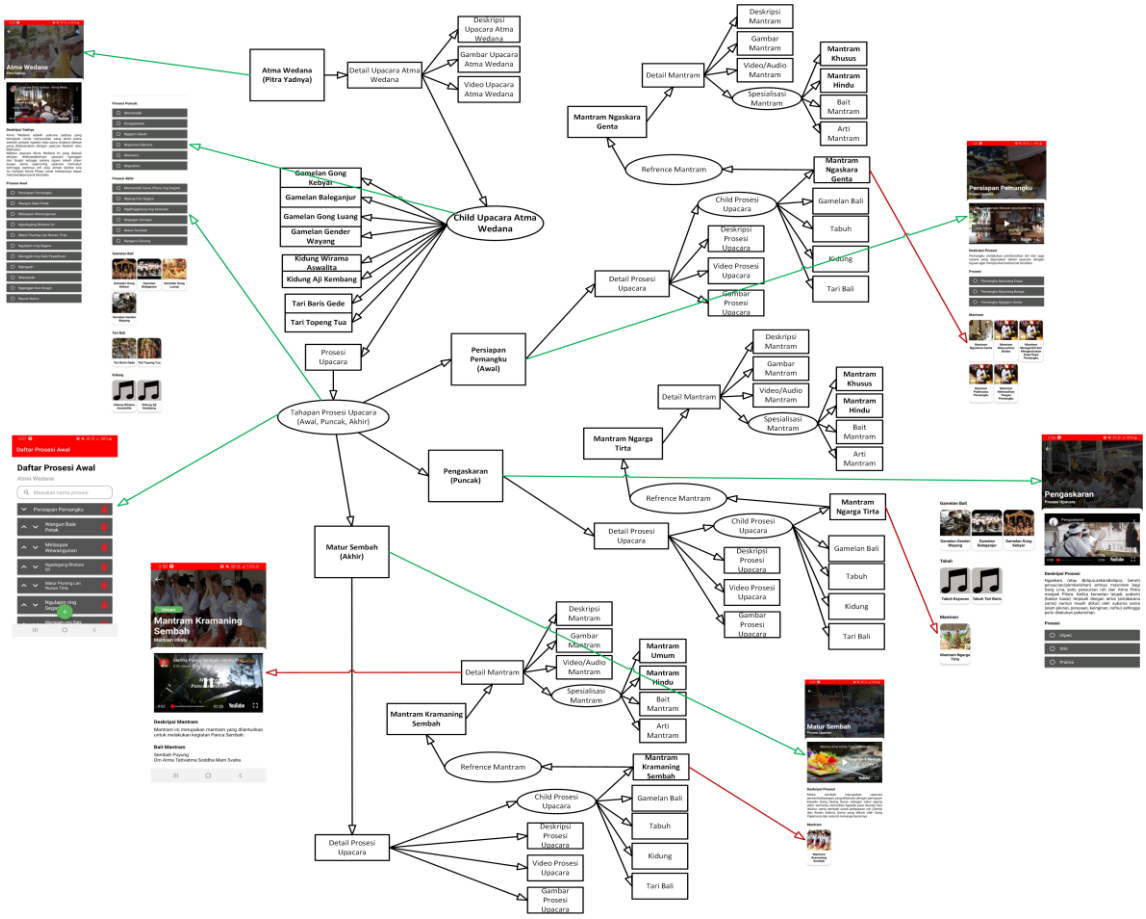


Figure 5. Tree Model Implementation in the E-Mantram Application

3.2. E-Mantram Application User Interface

The application user interface is a visual display of an application that aims to connect users with the system [19]. Tree Model implementation helped to simplify the process of describing entity relationships between *Yadnya* Ceremonies, Ceremonial Processions, and Balinese Hindu Mantram in the E-Mantram Application. The user interface of the E-Mantram application can be seen in Figure 6.

Figure 6. E-Mantram Application User Interface

Figure 6 is the user interface of the E-Mantram Application. It was developed based on the Tree Model that had been created. References taken from the Tree Model that had been developed were used to make it easier to display data on the relationship between each entity and be a reference for how to display data for *Yadnya* Ceremonies, Ceremonial Processions, and Mantram. Figure 6 also explains that the relation between the *Ngaskara Genta* Mantram and the *Atma Wedana* Ceremony lies in the *Pemangku* Preparation procession, where the *Pemangku* Preparation procession is a child of the *Atma Wedana* Ceremony, and the *Ngaskara Genta* Mantram is a child of the *Pemangku* Preparation procession.

3.3. UAT Result with PSSUQ Method

UAT with the PSSUQ method collected questionnaire data using Google Form, with 22 valid respondents collected. This questionnaire had four main subscales, namely System Usefulness (SYSUSE), Information Quality (INFOQUAL), Interface Quality (INTERQUAL), and Overall score. A list of 16 standard questions asked to respondents when filling out the PSSUQ questionnaire on Google Form can be seen in Table 2.

Table 2. 16 Standard Questions of PSSUQ Questionnaire

No.	Questions
1	Overall, I am satisfied with how the system is easy to use.
2	The system is simple to use.
3	I can complete tasks and scenarios quickly while using this system.
4	I feel comfortable using this system.
5	Easy to learn the use of this system.
6	I believe that I can be more productive using this system.
7	The system provides me with a clear error message to fix the problem.
8	Whenever I make a mistake while using the system, I can fix it easily and quickly.
9	Information (online help, on-screen messages, and other documentation) included in the system is self-explanatory.
10	Easy to get the information I need.
11	Information has been effective in helping me complete scenario tasks.
12	Arrangement Information on the system has been clearly arranged.
13	The system interface is convenient to use
14	I like to use this system interface screen.
15	This system has the functions and capabilities that I expect.
16	Overall, I am satisfied with this system.

Table 2 is a table with 16 standard questions of PSSUQ version 3. Through the list of 16 standard questions of PSSUQ version 3 above, the calculation results were carried out with the System Usefulness (SYSUSE) assessment that took the average value of questions 1-6. Further, Information Quality (INFOQUAL) took the average value of questions 7-12, and Interface Quality (INTERQUAL) took the average value of questions 13-15. The table of the UAT questionnaire results can be seen in Table 3.

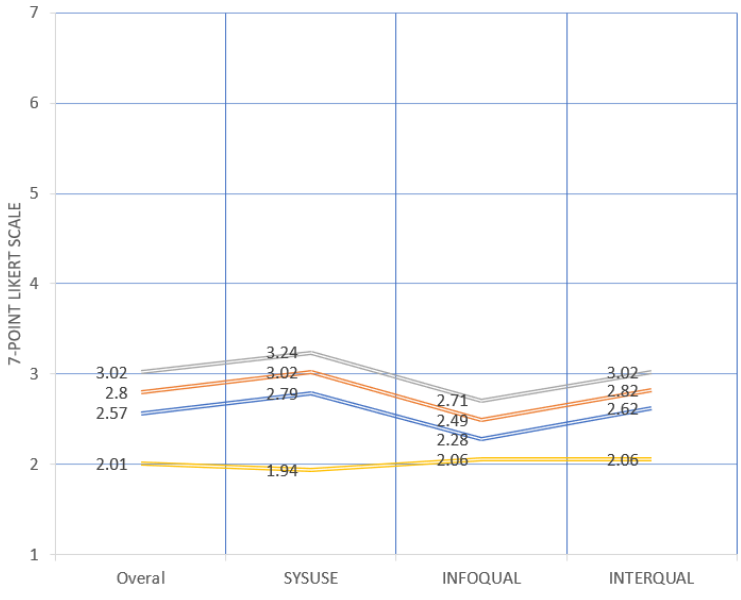
Table 3. The UAT Questionnaire Results with the PSSUQ Method

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
R1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2
R2	1	3	3	2	3	3	3	3	3	2	3	3	2	1	2	3
R3	1	3	3	2	6	4	4	5	4	6	5	3	4	3	3	3
R4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
R5	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
R6	1	1	1	2	1	1	2	1	1	1	2	1	1	1	2	1
R7	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1
R8	4	4	3	3	3	2	4	3	5	2	4	4	2	3	3	4
R9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
R10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R11	1	2	2	1	2	2	1	2	1	2	1	2	3	3	1	1
R12	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
R13	2	2	1	3	2	2	3	2	2	2	2	2	4	4	2	2
R14	2	2	3	3	3	4	2	3	3	1	2	2	3	3	1	1
R15	1	2	2	2	1	1	2	2	2	1	2	2	2	2	2	2
R16	2	1	1	2	2	1	2	2	1	1	1	1	2	3	1	1
R17	1	2	2	2	1	2	3	2	2	1	1	1	1	1	2	2
R18	2	1	1	3	2	4	4	2	2	3	2	2	2	2	3	2
R19	2	3	2	3	2	3	2	3	2	3	2	3	3	3	4	3
R20	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
R21	2	1	2	1	2	2	3	3	3	1	1	2	2	2	2	2
R22	3	2	2	2	3	2	2	2	3	2	2	2	3	3	3	2
R23	1.68	1.91	1.82	2.00	2.05	2.18	2.27	2.18	2.18	1.86	1.91	1.95	2.09	2.14	1.95	1.95

SYSUSE (1-6)	: 1.94
INFOQUAL (7-12)	: 2.06
INTERQUAL (13-15)	: 2.06
Overall (1-16)	: 2.01

Table 3 shows the PSSUQ questionnaire calculation results via Google Form. The data collected and processed in the table above was still in the form of numbers with the respondents and question tabs. Each question produced a different value depending on the answer chosen by the respondent based on whether or not the respondent agreed with each question given. The table shows the value of the average calculation results of each question item delivered to the respondent. The calculated data was compared with the scoring norms of PSSUQ version 3 and visualized with a line chart. The line chart of the questionnaire results using the PSSUQ method can be seen in Figure 7.



Lower Limit	2.57	2.79	2.28	2.62
Mean	2.8	3.02	2.49	2.82
Upper Limit	3.02	3.24	2.71	3.02
E-Mantram	2.01	1.94	2.06	2.06

Figure 7. Line Chart of Questionnaire Results with PSSUQ Method

Visualization of the comparison of the PSSUQ questionnaire calculation results will provide a comparison of the results for each value of System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL), as well as the overall value with the PSSUQ

version 3 assessment norm. Figure 7 is a line chart that compares the PSSUQ questionnaire calculation results with the assessment norm from PSSUQ version 3. The value of the questionnaire results when compared with the PSSUQ version 3 assessment norm and reaches the upper limit value, then a system or application can be categorized as quite acceptable by the user. If it reaches the lower limit value, a system or application can be categorized as acceptable by the user. If the value is below the lower limit value, a system or application can be categorized as very acceptable to the user.

4. Conclusion

Mobile-based application development with the Android E-Mantram Platform with the Tree Model implementation helped to simplify the description of the relationship process between Mantram entities, Yadnya Ceremonies, and Ceremonial Processions in the application. Then, the UAT testing of the E-Mantram application was carried out using the PSSUQ method. Taking the UAT questionnaire got 22 respondents, with the majority of respondents being students or college students. Respondents answered 16 standard questionnaire questions from the PSSUQ Method via Google Form. The results obtained from the UAT questionnaire with the PSSUQ Method were a score of 1.94 on the System Usefulness (SYSUSE) sub-scale, a score of 2.06 on the Information Quality (INFOQUAL) sub-scale, a score of 2.06 on the Interface Quality (INTERQUAL) sub-scale, and a score of 2.01 overall (Overall). The UAT questionnaire results showed that scores on all sub-scales got better results than the lower limit value on the PSSUQ scoring norm table. Therefore, it can be concluded that users could well receive the E-Mantram application.

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