Original Research Article

LOCATION-BASED SMART AIRPORT MODEL IN RADAR COURSE INTRODUCTION

ABSTRACT:
This study aims to determine the level of validity of the Smart Airport simulation design with location determination in the introduction of radar courses using ISO 25010 testing. The subjects of this research are material experts and media experts. The research procedure used by adapting the Research and Development (R&D) development model with the ADDIE method with 5 stages, namely: Analysis, Design, Development, Implementation, and Evaluation. To measure product quality, validation of material experts and media experts was used. The data sources are material experts, and media experts. The type of data is quantitative data (questionnaire). The instrument used in data collection is a questionnaire instrument using a Likert scale and a Guttman scale. The data collection technique was carried out by observation, and questionnaires. The data analysis technique used is descriptive analysis with reference to the quantitative data obtained. The results of this study are in the form of smart airport simulation design products at the Makassar Sultan Hasanuddin International Airport terminal as a solution to the needs of flight service users at the departure terminal that can be connected to smartphones as a medium for the convenience of passengers and Makassar Sultan Hasanuddin Airport managers. The results of ISO 25010 testing of smart airport applications in terms of validity amounted to 3.79 in the valid category.

Keywords: ISO 25010, Validity test, Smart Airport

1. INTRODUCTION

Sultan Hasanuddin International Airport Makassar which is the eastern gateway of Indonesia in serving the movement of passengers and goods [1], [2] and as an aviation network node is the starting point and end of the movement of people / goods [3]. Airport development should ideally have a large capacity so that it can serve aviation activities in the long term, where aircraft and passenger movement traffic activities tend to increase rapidly and services to passengers must be improved [4].
Based on passenger movement data published by PT Angkasa Pura I Sultan Hasanuddin International Airport Makassar as in the following table:

Table 1. Domestic Passenger movement data 2016-2020

In Year	Number of Passenger Movements						
	International		Domestic		Total Average/ Year	Average/ Day	Total Average/ Day (%)
	Average/ Year	%	Average/ Year	%			
2016	165.657	16%	10.591.258	20%	10.756.915	29.880	-
2017	228.591	23%	12.065.635	23%	12.294.226	34.151	87%
2018	233.932	23%	13.303.838	25%	13.537.770	37.605	91%
2019	308.626	31%	10.448.435	20%	10.757.061	29.881	-79%
2020	69.707	7%	6.027.367	11%	6.097.074	16.936	-57%
Total	1.006.513	100 %	52.436.533	100%	53.443.046	148.453	

(Source: PT Angkasa Pura I data in 2021)

Table 1 shows that the total number of domestic passenger movements [5] for arrival, departure, and transit from 2016 to 2022 amounted to 52,436,533 people. In 2016 it was 10,591,258 or around 20%, in 2017 it was 12,065,635, in 2018 it was 13,303,838, in 2019 it was 10,448,435 and in 2020 it was 6,027,367, where the number of international and domestic passenger movements can be averaged per day increased by 87% in 2017 and 91% in 2018. Passenger movements began to decline due to the covid -19 pandemic in 2019 by 79% and at the peak of the pandemic in 2020 dropped to 57% [6], and based on Circular Letter Number SE 56 of 2022 concerning Guidelines for the Implementation of Domestic Travel by Air Transportation during the Corona Virus Disease 2019 (Covid-19) Pandemic, for the movement of passengers by air has been opened and restrictions are no longer enforced so that it triggers an increase in users of transportation services by air and the density of passengers at the departure terminal and arrival terminal will be increasingly dense.

Table 2. Data on transit passenger movement at Makassar Sultan Hasanuddin International Airport

In Year	Domestic	International
2016	2.338.015	236
2017	2712023	378
2018	2.976.232	220
2019	2.153.778	1.138
2020	1.319.468	0

(Source: PT Angkasa Pura I data in 2021)

Based on Table 2 above, it appears that the number of flight service users transiting Makassar Sultan Hasanuddin International Airport in 2016 for domestic transit was 2,338,015 flight service users, which was 14% or 2,712,023 of the number of transit flight service users in 2017, in 2018 domestic flight service users in transit decreased by 9% or 2. 976,232 and at the beginning of the covid 19 pandemic hit Indonesia in 2019, the movement of flight service users decreased dramatically including the number of transit flight service users by -38% or 2,153,778 from the number of flight service users in 2019 and in 2020 also decreased by -36% or 1,319,468 flight service users per year.

If the above passenger movement conditions are averaged by the number of passenger movements per day for a year, then the number of movements of transit flight service users per day in 2016 was 6,406 flight service users, in 2017 the average number of movements of transit flight service users was 7,430 flight service users, in 2018 it was 8,154 flight service users. 2019 began to decline with the number of movements of transit flight service users amounting to 5,901,000. 2020 began to experience a decline with the number of movements of transit flight service users amounting to 3,615. The higher condition of the Covid pandemic has an impact on the use of air transportation modes, this is evidenced by the drastic decrease per day in 2019 of 2,253 flight service users per day, while in 2020 there was also a drastic decrease of 1,285 air flight service users per day.

2. BACKGROUND

Based on observations, the area of Sultan Hasanuddin International Airport Makassar is 53,045 m2 [7] with an increasing number of flights under normal conditions which, if referring to the data in Table 1, can be seen that the daily average of domestic and international flight service users for the last 5 (five) years, namely in 2016 as many as 29,880 people / day, in 2017 as many as 34,151 people / day, in 2018 as many as 37,605 people / day, in 2019 as many as 29,881 people / day and in 2020 as many as 16,936 people per / day. The decline occurred in 2019 and 2020 as a result of the co-19 pandemic, while the flight routes served by Sultan Hasanuddin International Airport Makassar averaged 238.8 thousand flights per year, and the most flight routes with the destination of Soekarno-Hatta International Airport Cengkareng-Jakarta with an average of 79.4 thousand / year.

From these data, and supported by the results of interviews with flight service users, it is still found that some flight service users/passengers do not understand the location of the facilities they need while in the terminal, flight service users still often experience problems finding airport information boards or directions according to the needs of flight service users, the availability of officers is still limited to certain times in the terminal and easily found by flight service users, an increase in the number of passengers based on flight data for the last 5 (five) years before the pandemic, and the density of passengers in the terminal area cannot be avoided so that by looking at this condition, flight service users need longer time to carry out their activities.

Similar conditions are experienced by the community as aviation service users who are increasingly dense in their activities, so they have limited time to make movements in the airport terminal when they are going to use air transportation. This causes airport services at the terminal to be a priority, in general passengers or flight service users experience route errors to the desired place, the occurrence of delays in passengers entering the aircraft due to the search for the location of the required facilities requires more time. The experience of flight service users while in the departure terminal or arrival terminal of an airport that is often visited is very important to make it easier for passengers to find the location of facilities and utilize the facilities provided by the airport management. Therefore, in addition to airport managers continuing to develop forms of services that can be provided to aviation service users, aviation service users should also be able to adjust to the development of services provided by airport managers.

On the other hand, it was found that some passengers who will make flights or who have landed at the airport and will continue their journey using land transportation modes experience delay conditions caused by departure delays or even time management from the passengers themselves, so that in utilizing limited time additional services are needed to facilitate passengers in finding the location

needed while in the airport terminal. An important point of passenger terminal feasibility is the ease of accessibility and comfort of passenger movement [8].
The above conditions imply that airport managers have a very large responsibility for the comfort of flight service users while in the terminal. Aviation service users are users who travel or move or move from their place of origin to their destination using air transportation, where security, safety and comfort are factors that must be provided to all aviation service users.
Facilities that can help aviation service users find the location of the required terminal facilities by utilizing the indoor Global Positioning System (GPS) system that provides convenience for the world to move quickly because of its contribution in finding and determining the location, speed and time synchronization that can be utilized.
Location determination applications apply the basic principles of radar systems, namely sending electromagnetic signals from the transmitting antenna to the target object, receiving back the reflected signal from the target by the receiving antenna, then processing the signal to determine target characteristics such as distance, direction, speed, and angle which are displayed in the form of displays in the form of radar signal processing results displayed on the screen, generally in the form of two-dimensional or three-dimensional displays, which show the position and movement of objects in the surrounding environment [9].
Implementing a radar system as a location determinant using a GPS device is less efficient indoors. Due to signal attenuation caused by construction materials, satellite-based GPS allows significant power loss when used indoors and will affect the range required for satellite receivers. In addition, multiple reflections on surfaces cause multi-path propagation to suffer from uncontrollable errors. These effects gave rise to a solution for indoor location that uses electromagnetic waves from an indoor transmitter to an indoor receiver.
Bluetooth Low Energy (BLE) beacon-based location tracking system is used for indoor mapping. The BLE system by building a 2 (two) dimensional indoor navigation system that places the user's position as the initial location of tracking, obtains the details of the destination according to the choice and calculates the navigation path that can be taken by the flight service user, in this condition utilizes the theory of Indoor Positioning System (IPS) designed based on Dijkstra's algorithm and also uses the Internet of Things (IoT) edge technology to improve performance and provide a platform for further analysis. An indoor positioning system (IPS) is a network of applications used to locate people or objects where GPS and other satellite technologies lack precision or fail altogether, such as inside high-rise buildings, malls, airports, parking garages, and underground locations [10].
The Djikstra algorithm works using a graph with the greedy principle of finding the minimum value of each node traversed by the search technique using Best First Search (BFS). BFS is by tracing the highest (initial) node then tracing to the node below [11]. In determining the route and travel time to the desired destination with the dijkstra algorithm approach on the Android mobile platform application is generally assisted by GPS to find the nearest location closest to the user's position [12].
Based on statistical data on mobile operating systems market share worldwide from January 2012 to January 2022, android reached the highest user value of 69.74% and IOS in the position of 25.49%. from these data it appears that most of the world community has switched to android smartphones that are able to provide some convenience in the application features offered to facilitate the fulfilment of the needs of its users.
The increase in android users over the past 10 years reached 69.74% and refers to statistical data in 2022 where a forecast or forcating of the number of smartphone users in the world until 2027 reached 7,690 billion smartphone users as shown in Figure 1. This indicates that the welfare of the world's population is increasing, technological equality has been realized throughout the world and the majority of the world's population has utilized technology in meeting its needs at any time.

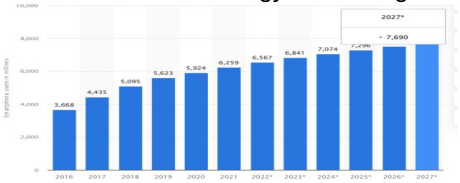


Fig 1. Forcasting smartphone users in 2016 - 2027
(Source: Puslitbang Aptika IKP Kominfo, 2017)
The android device was chosen because this device has many users and is supported by google, so the use of google maps is better and it is possible that the number will continue to increase, considering that android smartphone technology continues to improve. Based on the results of the 2017 ICT user survey, it shows that 66.3% of individuals have smartphones out of 6246 respondents and 33.69% of individuals do not have smartphones. The activities of smartphone users (n-6250)

when not connected to the internet were 95.68% for communication; 41.06% for entertainment; 17.52% for work and 13.97% for study, while the activities of smartphone users when connected to the internet were 93.46% for communication; 65.29% for entertainment; 76.88% for browsing; 27.51% for study and 25.70% for work [13].

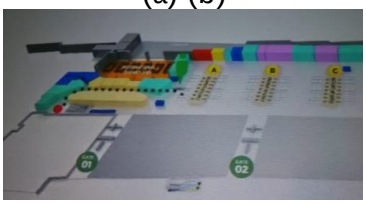
In short, with the construction of the airport arrangement and the vastness of the airport triggers several obstacles that are often faced by flight service users, namely not quickly knowing the location of several facilities provided by the airport manager such as *Mushollah* facilities, Toilets, ATM centers, Check In Counters, Exits, Rapid-antigen Validation and even other public services. This condition triggers the accumulation of passengers at one point, allowing passengers to go in the wrong direction to the airport facilities needed. Currently at Sultan Hasanuddin International Airport, Makassar, there are facilities that function to guide flight service users to find the public service facilities they need while in the terminal in the form of direction information in the form of arrows installed at several points as shown in the following figure:

Fig 2. Directions to the location of facilities at the terminal of Sultan Hasanuddin International Airport Makassar.

(Source: Field Documentation, 2022)

While information related to the location of public service facilities in the departure terminal and arrival terminal of Sukarno Hatta Cengkareng Airport is available in digitized form as shown in the following figure:

(a) (b)



(c)

Fig 3. Directions to the location of facilities at the terminal of Sukarno Hatta International Airport Jakarta

(Source: Field Documentation, 2022)

3. METHODOLOGY

The research procedure used by adapting the Research and Development (R&D) development model with the ADDIE method with 5 (five) stages, namely: Analysis, Design, Development, Implementation, and Evaluation. The subjects of this study were material experts and media experts. To measure the quality of the product, validation of material experts and media experts was used. The data sources are material experts, and media experts. The type of data is quantitative data (questionnaire). The instrument used in data collection is a questionnaire instrument using a Linkert scale and a Guttman scale. The data collection technique was carried out by observation, and questionnaires. The data analysis technique used is descriptive analysis with reference to quantitative data obtained using the IBM SPSS statistical software program 16.0 for Windows.

4. RESULTS

The development product in the form of a smart airport application design developed is completed, then the next step is the product validation stage of the smart airport application design by experts. The development model developed in the form of a smart airport application design that can provide direction information on the location of public service facilities at airport terminals that can be accessed by flight service users using smartphone devices.

By referring to the validator assessment data, the results of the validation test on the level of validity of the smart airport application design using ISO 25010 testing are obtained. The results of expert validation can be seen in Table 3.

Table 3. Test results of media expert design of smart airport applications using ISO 25010 testing of mobile application directions

No	Aspects assessed	Validator		Average	Description
		I	II		
1	Functionality Suitability	4	4	4	Valid
2	Usability	3	4	3.5	Valid
3	Compatibility	4	4	4	Valid
4	Reliability	4	4	4	Valid
5	Security	3.5	4	3.75	Valid
6	Portability	4	3	3.5	Valid
Total Average				3.79	Valid

(Source: Research data 2022)

5. DISCUSSION

Validity testing on smart airport application design is carried out using International Standardization Organization (ISO) 25010 testing which is part of the software quality testing system model (software testing) which replaces ISO 9126 for the readiness of a software product (software engineering) - Software product Quality Requirements Evaluation (Square) [14].

The ISO/IEC 25010 standard is a quality standard for testing software internationally that applies or is currently used. The ISO/IEC 25010 quality standard includes 8 (eight) characteristics or aspects, namely functional suitability, usability, performance efficiency, reliability, compatibility, security, maintainability, and portability which are translated into a series of sub-characteristics. This research did not test the performance efficiency aspect, and the maintainability aspect.

Based on the results of the assessment of each aspect assessed on the design of the airport smart application using a Guttman scale questionnaire for the Functionality Suitability aspect and a Linkert scale on the Compatibility, Reliability, security, usability, and portability aspects, all of which were assessed by 2 media expert validators, The highest average value was obtained in the aspects of Functionality Suitability, Compatibility and Reliability of 4, in the security aspect a value of 3.75 was obtained, while in the usability aspect and the portability aspect the lowest value was 3.5 so that the overall average aspect was 3.79 and was in the valid category. In addition, all validators concluded that the mobile application development model that had been developed could be applied with minor revisions.

6. CONCLUSION

Validity testing on smart airport application design is carried out using International Standardization Organization (ISO) 25010 testing, the highest average value is obtained in the aspects of Functionality Suitability, Compatibility and Reliability of 4, in the security aspect obtained a value of 3.75 while in the usability aspect and the portability aspect obtained the lowest value of 3.5 so that the overall average aspect is 3.79 and is in the valid category.

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