

# Factors Influencing the Determination of The Position of Passengers at The Airport Departure Terminal Sultan Hasanuddin Makassar

Fatmawati Sabur<sup>1,2,\*</sup>, Muhammad Yahya<sup>1</sup>, Purnamawati Purnamawati<sup>1</sup>, Mulyadi Nur<sup>1,2</sup>, Ucok Ucok<sup>3</sup>

<sup>1</sup>Makassar State University, Makassar 90222, South Sulawesi, Indonesia

<sup>2</sup>Makassar Aviation Polytechnic, Makassar 90243, South Sulawesi, Indonesia

<sup>3</sup>University of East Indonesia, Makassar 90222, South Sulawesi, Indonesia

\*Corresponding author. Email: [fatmawati.sabur@poltekbangmakassar.ac.id](mailto:fatmawati.sabur@poltekbangmakassar.ac.id).

## ABSTRACT

The challenges that often occur at the departure terminal are flight service users who pay less attention to the estimated travel time, conditions on the way to the airport (congested), parking locations that are far from the departure terminal, the antigen validation process, which takes more time, so that flight service users experience delays in registering at the departure terminal. Check in the airline counter at the departure terminal. Flight delays are often caused by lost passengers and unable to find their way to the right gate on time. The purpose of the study was to determine the factors that influence the use of mobile devices to determine the position of passengers while at the departure terminal. The research method used with this type of research is the Hasanuddin Airport Case Study with a description method approach. The research population is the public facilities available at the Sultan Hasanuddin Airport terminal, while the research sample is the facilities available at the departure entrance to the waiting room gate. The data collection technique is through Literature Study and Field Observation, while the data collection instrument is carried out by distributing questionnaires to passengers using flight services data analysis techniques by processing questionnaire data using the SPSS application. The study results show that the factors that greatly influence the positioning of passengers at the terminal by using mobile devices are social factors in the aspects of knowledge and abilities of passengers (habit) and the passenger's intention to use the application.

**Keywords:** Mobile, Passenger, BLE, Airport

## 1. INTRODUCTION

Airports carry out services for the movement of passengers and goods through air channels [1] or air transportation, where the challenge that often occurs at the departure terminal is that flight service users pay less attention to the estimated travel time conditions on the way to the airport (congested), parking locations far from the terminal. Departure, the antigen validation process more time, so that flight service users experience delays in reg Based on data on passenger movement for domestic flights at Sultan Hasanuddin Makassar airport in 2016, it reached 20.2%, in 2017 it was 23%, in 2018, it was 25.4%, and it started to decline due to the COVID-19 pandemic in 2019 by 19.9% and peaked the 2020 pandemic fell by 11.5%. The COVID-19 pandemic conditions, forcing flight operators and flight service users to implement a healthy lifestyle with the implementation of health protocols and to check the health conditions of passengers when arriving and leaving Sultan Hasanuddin Airport so that passengers need more time each time they travel by air.

Passenger delays are often also caused by passengers who get lost and cannot find the direction of the required facilities (test validation services, prayer rooms, toilets, etc.) on time, especially during the pandemic where several access movements are diverted for automatic passenger body temperature measurements, passengers are parsed so that there is no accumulation at one service point and supported by technological developments at this time there are several technologies that can be used to help passengers find out their position while in the terminal. The application of the Indoor Positioning system is because GPS technology cannot be applied to indoor position tracking.

By utilizing devices commonly owned by visitors in the form of technology smartphones and Wi-Fi devices that are generally available in the rooms, it can be used to find out the position of smartphone users.

However, Wi-Fi with many obstacles in the room is also an obstacle in getting a stable and accurate RSSI value, so other approaches are needed to increase accuracies, such as the use of filter algorithms and the use

of iBeacon BLE (Bluetooth Low Energy) as a hybrid technology related to its use as a shared indoor position system with Wi-Fi technology. To provide passenger comfort in knowing their position in the indoor room, we need an interface that is compatible with smartphones where the visualization of the floor plan can be zoomed in like using a map application, that SVG technology which is an interactive vector-based visualization can be used as an alternative in making floorplans that can be enlarged without reducing the quality of the display as well as lighter than the use of floorplans images.

Technically, mobile devices can make it easier for passengers to find a position; this needs to be supported by social factors to maximize positioning applications by utilizing their mobile devices.

The social factors that influence is the influence of passenger knowledge on the positioning application provided by the airport manager, the readiness of passengers who will be used to take advantage of the passenger positioning application, the time range that passengers must be able to take advantage of the positioning application, as well as the ability of everyone. Passengers can use the car device to be coordinated with the positioning application provided by the airport manager so that passengers can find the facilities needed quickly without the help of instructions from the crew or airport officers.

## 2. METHOD

The Hasanuddin Airport Case Study research type is the research type with a correlational approach. The research population is all public facilities at the Sultan Hasanuddin Airport terminal, while the research sample is the facilities available at the departure entrance to the waiting room gate. The data collection technique is through Literature Study and Field Observation, while the data collection instrument is carried out by distributing questionnaires to passengers using flight services data analysis techniques by processing questionnaire data using the SPSS application.

The analytical procedure in this study was carried out in 2 stages, namely stage 1, psychometric properties with correlational analysis, while stage 2 focused on testing technical positioning applications.

## 3. RESULT AND DISCUSSION

Several things need to be considered in determining the factors that influence smartphone positioning, divided into technical factors (x) and social factors (y).

Technical factors can refer to (x1) mobile device position estimation can be done with RSSI and trilateration techniques [2], (x2) Positioning accuracy improvements can be improved by smoothing and

filtering data from beacons [3], (x3) Design of search and determination systems object position using SVG image format [4], (x4) Comparison of data transmission protocols using HTTP and MQTT [5], (x5) Application of mesh networks on heterogeneous networks [6].

Meanwhile, from the social factor (y) obtained from the questionnaire results distributed to passengers who will go to the departure terminal waiting room and those in the departure waiting room. From the results of the questionnaire, it is known that the respondent's response to (y1) knowledge of passengers using the passenger positioning application is 30%, (y2) Passenger readiness to use the application as a position guide is 60%, (y3) the time range owned by passengers is 70%, (y4) the ability of passengers to adapt to technology by using a position guidance application of 98%, so the most influential factor from a social point of view is y4 the ability of passengers to adapt to technology using position guidance applications of 98%. Similar research states that social factors are strongly influenced by technological advances and low public awareness about them [7]. The external factor that is also responsible for providing knowledge to the public who will use flight services related to the applications implemented at the airport is the mass media [8]. Besides that, socialization can also provide knowledge to the public regarding passenger service facilities provided at the airport. For example, in mobile wallets, the habit factor has the most significant influence [9].

Meanwhile, in designing the positioning of passengers on the facilities needed while at the airport departure terminal, combining BLE and Wi-Fi using a small optimized subset of each facility installed at the airport departure terminal, users can find out the estimated location of the user to the airport. The location of the required terminal facilities. The IPS (*Indoor Position System*) approach is made by designing a *floor plan* and recording each facility's coordinates in the terminal. Furthermore, design the real-time monitoring architecture by utilizing the MQTT protocol. The solution has two subsystems that communicate via a mobile web interface accessible via a *smartphone*. The first subsystem determines the location of the *smartphone* user in the departure terminal room. This subsystem uses a Wi-Fi network because it is an existing public infrastructure and is economically viable. As well as the addition of *BLE (Bluetooth low energy) beacons* installed at every facility in the airport departure terminal room.

Based on the explanation above, can be seen several factors that influence the positioning of passengers on public facilities at the airport departure terminal, namely:

- a. The RSSI method is used to measure signal strength and estimate the distance between the receiving node

- and the transmitter node by utilizing the RSSI filter technique to reduce noise variations from the RSSI reading results,
- b. The RSSI value filter process is used to smooth the noise value of the varying RSSI readings, resulting in a less precise distance estimate.
  - c. The concept of a Mesh Network is a form of connection between devices directly connected in a network.
  - d. Bluetooth Low Energy technology is a wireless communication technology used to exchange data using radio waves with a frequency of 2.4 GHz [10]. This technology can enable connectivity between different devices, such as headsets with smartphones, cars, or computers.
  - e. Indoor location to find out the coordinate position in indoor [11].
  - f. The trilateration concept is to estimate the user's position by calculating the user's distance from the signal transmitter and the transmitter's coordinate position by utilizing the intersection of beacon nodes.
  - g. Floor plan concept as vector-based visualization of indoor 2D conditions
  - h. System protocol communication between devices using MQTT, and
  - i. System architecture describes the integration of all devices used in designing a real-time user position estimation system that can be monitored on a smartphone device.

In simple terms, the technical factors that affect the position of passengers at the airport can be described as follows:

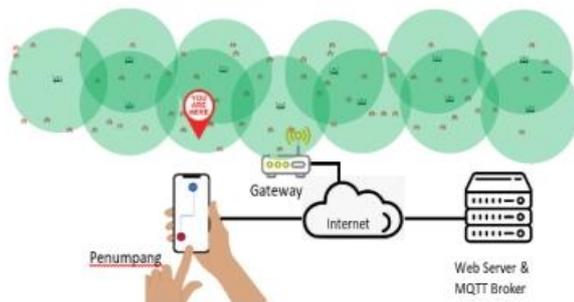


Figure 1. System Architecture

In this study, the factors that influence the positioning of passengers while in the departure terminal have been described. The technical factor is implementing an Indoor Positioning System (IPS) based on BLE technology and the MQTT protocol. The RSSI technique combined with the trilateration methodology is used to estimate the position of mobile devices based on a 2-part linearization algorithm so that the resulting system is in the form of estimating the position of passengers on the public facilities they need in real-time and can be monitored via smartphones and social factors where the role of passengers in utilization can be measured. Smartphones

to fulfill the passengers' needs for the facilities they need while in the departure terminal.

#### 4. CONCLUSION

Analysis of device tests on positioning applications and analysis results from questionnaires distributed to passengers, there is a high correlation between social factors in terms of passengers and application utilization and technical factors in terms of hardware and software devices used to build the positioning device by utilizing the device smartphones. The total of social factors that affect positioning is 98% influenced by the factor (y4) the ability of passengers to adapt to technology using position guidance applications.

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#### REFERENCES

- [1] F. Sabur, "Pengaruh Pergerakan Pesawat Komersial terhadap Pergerakan Penumpang di Bandara Blimbingsari Banyuwangi," *Airman J. Tek. dan Keselam. Transp.*, vol. 2, no. 1, pp. 12–28, Jun. 2020, doi: 10.46509/ajtk.v1i2.15.
- [2] K. Mekki, E. Bajic, and F. Meyer, "Indoor positioning system for iot device based on ble technology and mqtt protocol," in *IEEE 5th World Forum on Internet of Things, WF-IoT 2019 - Conference Proceedings*, 2019, pp. 787–792, doi: 10.1109/WF-IoT.2019.8767287.
- [3] A. K. Kereyev, S. K. Atanov, K. P. Aman, Z. K. Kulmagambetova, and B. T. Kulzhagarova, "Navigation system based on bluetooth beacons: Implementation and experimental estimation," *J. Theor. Appl. Inf. Technol.*, vol. 98, no. 8, pp. 1187–1200, 2020.
- [4] K. Liu, G. Motta, B. Tuncer, and I. Abubhashish, "A 2D and 3D Indoor Mapping Approach for Virtual Navigation Services," in *Proceedings - 11th IEEE International Symposium on Service-Oriented System Engineering, SOSE 2017*, Jun. 2017, pp. 102–107, doi: 10.1109/SOSE.2017.13.
- [5] T. Yokotani and Y. Sasaki, "Comparison with HTTP and MQTT on required network resources for IoT," in *ICCEREC 2016* -

- International Conference on Control, Electronics, Renewable Energy, and Communications 2016, Conference Proceedings, 2017, pp. 1–6, doi: 10.1109/ICCEREC.2016.7814989.*
- [6] S. S. Basu, M. Baert, and J. Hoebeke, “Qos enabled heterogeneous ble mesh networks,” *J. Sens. Actuator Networks*, vol. 10, no. 2, 2021, doi: 10.3390/jsan10020024.
- [7] A. Fauzi, “Penerapan Location-Based Service pada Layanan Informasi Budaya Indonesia di Perangkat Mobile,” *Fakt. Exacta*, vol. 8, no. 3, pp. 250–260, 2015.
- [8] A. Hendryani and E. Susana, “Pengembangan Aplikasi Mobile Health Berbasis Android untuk Monitoring dan Evaluasi Stunting,” *J. Sehat Mandiri*, vol. 15, no. 1, pp. 24–32, 2020, doi: 10.33761/jsm.v15i1.188.
- [9] A. Ispriandina and M. Sutisna, “Faktor-Faktor Penerimaan Teknologi Yang Memengaruhi Intensi Kontinuitas Penggunaan Mobile Wallet Di Kota Bandung,” *Pros. Ind. Res. Work. Natl. Semin.*, vol. 10, no. 1, pp. 1046–1055, 2019.
- [10] D. Chen, K. G. Shin, Y. Jiang, and K. H. Kim, “Locating and tracking BLE beacons with smartphones,” *Conex. 2017 - Proc. 2017 13th Int. Conf. Emerg. Netw. Exp. Technol.*, pp. 263–275, 2017, doi: 10.1145/3143361.3143385.
- [11] W. Chen, K. Chen, J. C. P. Cheng, Q. Wang, and V. J. L. Gan, “BIM-based framework for automatic scheduling of facility maintenance work orders,” *Autom. Constr.*, vol. 91, 2018, doi: 10.1016/j.autcon.2018.03.007.