# Creating a Mobile E-Wallet for Visual Impairment Using an Inclusive Design Approach: A Case Study in Bandung, Indonesia

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**Abstract.** In Indonesia, the rapid growth of Fintech has brought convenience to the general population, offering access to financial services and seamless fund transfers. However, this progress hasn't been fully inclusive, leaving individuals with visual impairments at a disadvantage. Based on data collected from a sample of 10 visually impaired respondents in Bandung, three primary challenges were identified when using E-Wallet applications: inaccuracies in screen reader interpretation of app displays, limitations in utilizing gesture-based functions such as 'slide to pay,' and lengthy transaction processes. This study's objective was to create an inclusive Fintech mobile application that provides comprehensive accessibility for screen reader users, employing the Inclusive Design Methodology. Evaluation, utilizing the System Usability Scale (SUS) and the Single Ease Question (SEQ) with the same 10 visually impaired participants, resulted in a high level of usability, as evidenced by an SUS score of 93 and a SEQ score of 67. These findings signify the successful development of an accessible and user-friendly Fintech application for individuals with visual impairments, bridging the accessibility gap within the Fintech sector in Indonesia.

**Keywords:** First Keyword, Second Keyword, Third Keyword. Inclusive Design, E-Wallet, User Experience, User Interface, Usability, SUS, Visual Impairment

## 1 Introduction

The development of IT services has made many changes in people's lives. One of the rapidly growing IT services is in the financial sector. These findings are further substantiated by the emergence of smartphones and Fintech (Financial Technology).

In Indonesia, Fintech offers numerous conveniences to the community, including access to financial loans and seamless fund transfers. However, the development of IT services in the financial sector cannot be enjoyed by people with disabilities, especially those with visual impairments. This state is due to the lack of accessibility to financial services [1]. The result of this lack of accessibility in the financial sector can also be seen based on the results of a survey by the Ministry of National Development Planning of the Republic of Indonesia / National Development Planning Agency in 2021 in


M. D. Sulistiyo and R. A. Nugraha (eds.), *Proceedings of the International Conference on Enterprise and Industrial Systems (ICOEINS 2023)*, Advances in Economics, Business and Management Research 270,
https://doi.org/10.2991/978-94-6463-340-5_2

Figure 1 pertaining to data on ownership of savings accounts there is only 26.64% ownership of savings accounts by people with disabilities in Indonesia [2]. This figure is significantly disproportionate when juxtaposed with the ownership rates among individuals without disabilities, which stand at 63.55% [2].

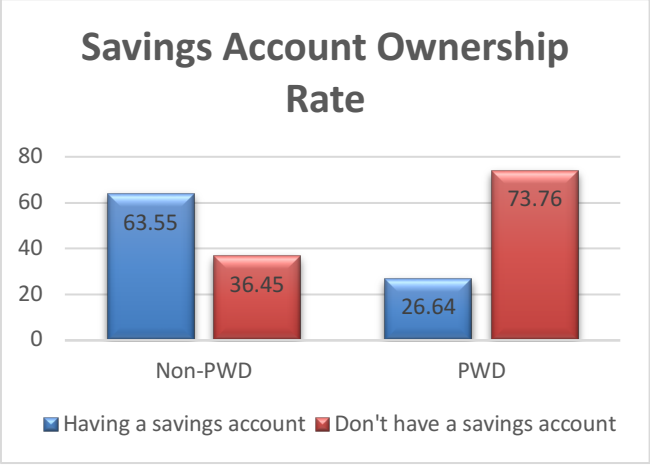


**Fig. 1.** Indonesia Saving Account Ownership Rate

With these problems, novel interventions are imperative to support individuals with disabilities, especially people with visual impairments, so they can utilize fintech applications without being limited by low accessibility. According to a survey conducted by Indonesian Statistics Centre, the data reveals that the prevalence of visual impairments constituted at least 63% of the types of disabilities in Indonesia in 2020 [2].

Derived from data collected from 10 visually impaired respondents in Bandung, empirical evidence indicated the existence of three prevailing challenges for these individuals when using the E-Wallet: namely, the screen reader that cannot read the app display accurately; constraints on using gesture functions, such as slide to pay; and lengthy process to perform one transaction. this can also be seen from Table 1 which displays the results of the SUS test on the existing fintech E-Wallet application.

**Table 1.** Comparison of SUS Score On Existing E-Wallet

| No | E-Wallet | SUS Score |
|---|---|---|
| 1 | OVO | 45.63 |
| 2 | DANA | 47.5 |
| 3 | GoPay | 68.57 |
| 4 | ShopeePay | 43.33 |

In Table 1, it can be seen that the SUS score for the existing fintech E-Wallet application is still below the SUS acceptance level. The objective of this study is to develop an E-Wallet mobile application that is comprehensively accessible to screen

reader users. This study centers on individuals with visual impairments residing in West Java, Indonesia.

## 2 Literature Review

### 2.1 Fintech (Financial Technology)

Fintech is a way of using technology to provide financial solutions [3]. Following a long historical development, fintech is widely known as the incorporation of IT into financial services [4]. The evolution of fintech globally is divided into three stages ranging from fintech 1.0 (1886-1967), fintech 2.0 (1968-2008), and fintech 3.0 (2008-present) [3].

The inception of fintech in Indonesia originated in the 1980s when BCA (Bank Central Asia) and Bank Niaga took the lead by introducing ATM (Automated Teller Machine) services, marking the commencement of fintech development in the country [5]. As a result of these advancements, the landscape of fintech in Indonesia has evolved to encompass five distinct categories of services, as outlined by BFI [6]:

- **P2P (Peer to Peer Lending Service),** a fintech service in the form of lending funds through online media.
- **Micro financing**, a fintech service that targets people in the lower middle class to provide loans with low interest rates.
- **Crowdfunding**, a fintech service that provides access to funding for social movements.
- **Market Aggregator**, a fintech service that provides convenience in the process of comparing various financial products.
- **Digital Payment System**, a service that provides convenience in conducting instant transaction processes such as payment of electricity bills.

Broadly speaking, the presence of fintech in Indonesia has yielded numerous advantages for both entrepreneurs and the wider populace, encompassing [6]:

- Simplified transactions.
- Easy access to funding.
- Reducing operational costs.
- Supporting economic development.

**E-Wallet**

E-Wallet is one of the fintech digital payment system services which is a server-based payment tool [7]. The development of E-Wallet aims to encourage digital payments to become safer and easier transactions. With E-Wallet, users no longer need money in physical form or credit while using E-Wallet [8]. The other advantages of E-Wallet are [9]:

- Provides a secure payment system.

- Money-back guarantee if there are problems during the transaction process.
- A user-friendly way of use.

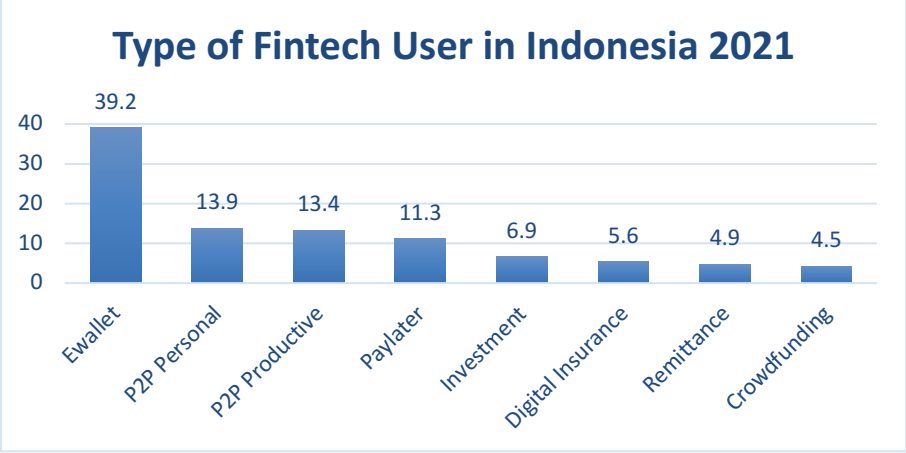


**Fig. 2.** Indonesia Fintech User in 2021

In Figure 2 about the results of a survey conducted by DailySocial to 1,435 respondents in 2021, it stated that E-Wallet is the most widely used Fintech service in Indonesia with a total of 40% of users and P2P lending is in the second position with a total of 13.9% of users [10].

## 2.2 Visual Impairment

Visual impairment is one of the motor disabilities with the highest percentage of disabilities in Indonesia in 2020, reaching 63.7% [10]. Based on the causative factors, visual impairment is classified into three categories: prenatal, neonatal, and postnatal. An explanation of the three causative factors will be clarified as follows :

- **Prenatal**: Prenatal factors are causes of blindness that occur before birth.
- **Neonatal**: The neonatal period is when visual impairment occurs due to factors during the birth process, such as premature birth or birth assisted by devices.
- **Postnatal**: Postnatal factors pertain to causes of blindness that manifest after birth or during developmental stages.

In Indonesia today, there are still numerous public services that fail to fulfil the requirements of individuals with disabilities owing to the absence of accessibility [11]. Kat Holmes [12], in her book titled "Mismatch: How Inclusion Shapes Design," asserts that accessibility is a specialized field characterized by its ability to attain qualities that enable inclusive experiences for everyone. Ensuring accessibility is crucial for developers, business owners, and organizations to facilitate the usage of the products or services they offer to individuals. Enhancing accessibility will provide benefits not

just to people with disabilities, but also to elderly individuals and those residing in developing nations [13].

### 2.3 Related work

E-Wallet is the most widely used fintech digital payment system service in Indonesia. According to a survey conducted by World Global Payment in 2019-2020, E-Wallets will surpass all payment methods with a figure reaching 16% market share globally and will continue to increase to 47% in 2022 [14]. However, there are challenges in building this technology, especially for people with disabilities. According to a study conducted by Nathan W. Moon [15] states, the challenge in developing this technology is how to build personalization for people with disabilities without increasing complexity and reducing functionality. Another challenge mentioned that application designers and developers are unfamiliar with the concept of usability and understanding the needs of people with disabilities [15]. Another study titled "Smartphone: A Smart Assistive Device for People with Visual Disabilities among COVID-19 Pandemic" [16] also revealed that another challenge is the difficulty for people with disabilities in transitioning to touchscreen technology and the absence of related recommendations by ophthalmology practitioners. Inclusive design as one of the methods that can provide accessibility to people with disabilities will be used as a methodology in this study [17].

## 3 Methodology

### 3.1 Inclusive Design

This study will use the inclusive design method as a methodology. Inclusive design is a methodology used to create products that can understand users from all backgrounds and abilities, including people with disabilities [18]. Meanwhile, according to the University of Cambridge, inclusive design is about making design decisions that better understand the diversity of users, including variations in abilities and needs, such as people with disabilities [19]. Figure 3 will illustrate the four primary processes involved in inclusive design.

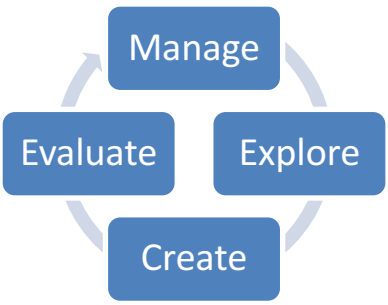


**Fig. 3.** Inclusive Design Process

Referring to the University of Cambridge, the explanation of the four main stages in inclusive design are:

- **Manage**: in Inclusive Design, manage aims to review to decide what to do next. Reviewing each step of the process and making sure there is open communication with team members are both recommended for effectiveness.
- **Explore**: gathers a deeper understanding of what criteria the product must meet. This is very important to ensure that the product meets the right needs. This phase requires understanding from all stakeholders including the users who will use our product.
- **Create**: stage to create all possible solutions to meet the needs of the users. This phase includes many activities that are generally considered part of concept design.
- **Evaluate**: assessing if the needs have been fulfilled.

# 4 Implementation and Result

## 4.1 Implementation

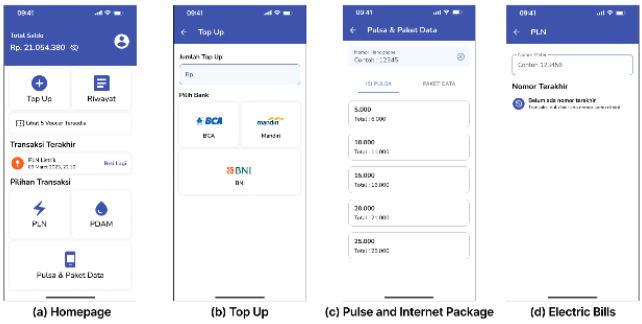


**Fig. 4.** Visipay Main Feature

The prototype is made using Flutter for Android mobile so that it can be supported with the Talkback feature that is already available built into on Android mobile phones. As for Figure 4 shows the design of the four main features in VisiPay.

## 4.2 SUS (System Usability Scale)

SUS is one of the methods founded by John Brook [20] which is simple to evaluate usability. SUS consists of 10 items that represent a subjective assessment of usability. Below are the 10 original questions from SUS shown in Table 2.

**Table 2.** SUS Questionnaire

| No. | Question |
|---|---|
| 1 | I think that I Would like to use this system frequently |
| 2 | I found the system unnecessarily complex |
| 3 | I thought the system was easy to use |
| 4 | I think that I would need the support of a technical person to be able to use this system |
| 5 | I found the various functions in this system were well integrated |
| 6 | I thought there was too much inconsistency in this system |
| 7 | I would imagine that most people would learn to use this system very quickly |
| 8 | I found the system very cumbersome to use |
| 9 | I felt very confident using the system |
| 10 | I needed to learn a lot of things before I could get going |

SUS questions are given when the respondent has had time to try the system to be tested. Each question will be provided with answer choices in the form of a 1-5 scale from strongly disagree to strongly agree [20].

**SUS Scoring**

- For questions with odd numbers, subtract the answer scale number by 1.
- For questions with even numbers, perform the 5-number scale answer equation.
- For questions for even numbers, do the 5-number scale answer equation.
- Sum up all the numbers after the equation and multiply by 2.5 to get the final SUS score.

With adjective rating, then the assessment for the usability level will be mapped descriptively [21], [22]. Table 3 will display the scale of the adjective rating.

**Table 3.** SUS Adjective Rating

| SUS Score | Adjective Rating |
|---|---|
| >90.9 | Best Imaginable |
| 85.5-90.8 | Excellent |
| 71.4-85.4 | Good |
| 50.9-71.3 | Ok |
| 35.7-50.8 | Poor |
| 20.3-35.6 | Awful |
| 12.5-20.2 | Worst Imaginable |

**SUS Result**

The SUS evaluation in this study will be conducted for two iterations to 10 respondents with visual impairments in Bandung, Indonesia. The results of SUS in this study will be displayed in Table 4 and Table 5.

**Table 4.** Iteration 1 SUS Score

| SUS Score | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Q1*** | ***Q2*** | ***Q3*** | ***Q4*** | ***Q5*** | ***Q6*** | ***Q7*** | ***Q8*** | ***Q9*** | ***Q10*** | ***Final Score*** |
| 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 95 |
| 4 | 2 | 4 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 70 |
| 3 | 3 | 2 | 3 | 2 | 4 | 3 | 4 | 4 | 2 | 75 |
| 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 2 | 75 |
| 2 | 4 | 3 | 4 | 3 | 2 | 1 | 3 | 4 | 4 | 75 |
| 4 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 87.5 |
| 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 92.5 |
| 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 97.5 |
| 3 | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 92.5 |
| 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 92.5 |
| ***Total*** | | | | | | | | | | 85.25 |

**Table 5.** Iteration 2 SUS Score

| SUS Score | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Q1*** | ***Q2*** | ***Q3*** | ***Q4*** | ***Q5*** | ***Q6*** | ***Q7*** | ***Q8*** | ***Q9*** | ***Q10*** | ***Final Score*** |
| 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 95 |
| 4 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 2 | 85 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 95 |
| 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 4 | 87.5 |
| 3 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 92.5 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 97.5 |
| 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 3 | 92.5 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 100 |
| 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 97.5 |
| 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 87.5 |
| ***Total*** | | | | | | | | | | 93 |

Based on the SUS score results from Table 4 and Table 5, the score has reached above 80, which has reached the target acceptance criteria with a minimum value of 70. The increase in SUS scores during the first iteration, measuring 85.25, and the next iteration, measuring 93, can be attributed to the fulfilment of the majority of respondents' requirements during the first iteration [22].

### 4.3 SEQ (Single Ease Question)


**Fig. 5.** SEQ Scale

SEQ is one of the methods used to assess usability and acceptability, which uses 7-point rating scales ranging from 1 (for very difficult) to 7 (for very easy scales) [23], [24]. SEQ will be conducted right after users work on the given task. The advantage of using SEQ is to find out the part of the application that is still lacking in terms of usability and acceptability, so it can be improved quickly. This test will be conducted in two iterations with 10 respondents with visual impairments in Bandung, Indonesia. The results of the SEQ in this study are shown in Table 6 and Table 7 (see Fig. 5).

**Table 6.** Iteration 1 SEQ Score

| **SEQ** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Q1*** | ***Q2*** | ***Q3*** | ***Q4*** | ***Q5*** | ***Q6*** | ***Q7*** | ***Q8*** | ***Q9*** | ***Q10*** | ***Total Score*** |
| 6 | 6 | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 7 | 65 |
| 1 | 1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 58 |
| 6 | 7 | 7 | 7 | 6 | 7 | 5 | 7 | 7 | 7 | 66 |
| 6 | 7 | 6 | 5 | 6 | 5 | 4 | 6 | 7 | 7 | 59 |
| 7 | 5 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 66 |
| 6 | 6 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 | 66 |
| 6 | 6 | 7 | 7 | 7 | 6 | 7 | 7 | 6 | 7 | 66 |
| 7 | 5 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 67 |
| 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 68 |
| 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 69 |
| ***Total Score*** | | | | | | | | | | ***650*** |
| ***Final Score*** | | | | | | | | | | ***65*** |

**Table 7.** Iteration 2 SEQ Score

| **SEQ** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Q1*** | ***Q2*** | ***Q3*** | ***Q4*** | ***Q5*** | ***Q6*** | ***Q7*** | ***Q8*** | ***Q9*** | ***Q10*** | ***Total Score*** |
| 7 | 6 | 7 | 5 | 7 | 7 | 6 | 6 | 6 | 7 | 64 |
| 6 | 6 | 7 | 5 | 7 | 6 | 5 | 5 | 5 | 7 | 59 |
| 7 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 68 |

| SEQ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Q1*** | ***Q2*** | ***Q3*** | ***Q4*** | ***Q5*** | ***Q6*** | ***Q7*** | ***Q8*** | ***Q9*** | ***Q10*** | ***Total Score*** |
| 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 69 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 70 |
| 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 69 |
| 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 69 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 70 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 70 |
| 7 | 7 | 7 | 6 | 7 | 7 | 6 | 6 | 6 | 7 | 66 |
| ***Total Score*** | | | | | | | | | | ***674*** |
| ***Final Score*** | | | | | | | | | | ***67.4*** |

Based on the SEQ score results from Table 6 and Table 7, the SEQ Score has reached 67.4 out of 70, and it proves that Visipay has achieved good acceptability and usability.

## 5 Conclusion and Future Work

The outcome of this study is a fintech mobile application that is comprehensively accessible to screen reader users using Inclusive Design Methodology. From the SUS results above, it has been found that the Visipay application reaches 93 for the second iteration and has reached a minimum acceptance rate of 70, and SEQ Result, Visipay reaches score for 67.4 out of 70. From the SUS and SEQ results, it can be proven that the Inclusive Design Methodology can better understand the diversity of users, including variations in abilities and needs, such as people with disabilities.

However, this study still has limitations that can be improved in future studies. Namely, currently the respondents in this study only consist of 10 visually impaired people located in Bandung, Indonesia. Therefore, of course, future studies can increase the number of respondents not only limited to the Bandung area, but also can expand the scope of respondents throughout Indonesia.

Secondly, the main features in Visipay are currently limited to purchasing credit, water bills, and electricity bills. This can certainly be expanded in order to expand the service features offered by Visipay. Additional features that could be improved based on feedback from the respondents interviewed are transfer services to fellow users or other financial services and the addition of login options using a biometric system.

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