Evaluating the Usability of a Navigation Mobile Application Using the System Usability Scale (SUS)

ABSTRACT

This study evaluates the perceived usability of two widely used navigation applications, Google Maps and Waze, with a focus on their performance in Malaysia. The research uses the System Usability Scale (SUS) to measure user satisfaction and ease of use for both apps. The findings indicate that Google Maps generally outperforms Waze in terms of usability, with a higher mean SUS score and greater consistency in user perceptions. Google Maps was preferred by respondents for its comprehensive features, such as more detailed destination information, offline functionality, and compatibility across devices. In contrast, Waze users reported frustration due to frequent route changes and the overwhelming number of traffic reports, which at times led to confusion. The results of this study provide valuable insights into user preferences and the effectiveness of these navigation systems in real-world settings, particularly in the context of increasing traffic congestion and road safety concerns. However, the study's conclusions are limited by its small sample size and regional scope, which should be considered when generalizing the findings.

General Terms

This study looks at how easy and effective two popular navigation apps, Google Maps and Waze, are for users. It uses a standard usability test to measure how well each app works and how satisfied people are with them. The results show that users find Google Maps easier to use and more reliable than Waze.

People prefer Google Maps for its helpful features, ability to work offline, and compatibility with different devices. On the other hand, Waze users reported frustration because of frequent changes in their routes and too many traffic updates. The study offers useful information about which app is better for users dealing with traffic and road safety issues. However, the study's conclusions are based on a small number of users and should be considered carefully.

Keywords

System Usability Scale (SUS), user satisfaction, traffic congestion, route planning, mobile apps, user experience.

1 INTRODUCTION

The use of navigation systems has expanded beyond just helping drivers in unfamiliar areas. It is now also used to check routes in advance to avoid traffic congestion. This capability is increasingly important as global road traffic density is expected to double by 2040 compared to 2015, leading to significant traffic jams, which are already becoming evident today.

Navigation systems help drivers select the quickest or most convenient route from multiple options provided by the system. These systems rely on Global Positioning System (GPS) technology, which consists of a network of operational satellites arranged in six orbital planes around Earth. These satellites, positioned at specific elevation angles, offer accurate location data. Navigation systems are also widely accessible as smartphone apps.

Google Maps and Waze are two of the most popular mobile navigation apps. Google Maps, developed by Google, is a web-based mapping service that offers route planning, 360-degree panoramic views, traffic conditions, and more. This GPS-based system also uses cell tower triangulation in conjunction with GPS data to deliver real-time, interactive services. In addition, Google Maps includes features like traffic updates and information about nearby points of interest, such as restaurants and landmarks.

This case study is implemented to check the usability perceived of user towards Google Maps and Waze.

2 METHODOLOGY

2.1 Overall research methodology

The System Usability Scale (SUS) evaluation is used to measure perceived usability of Google Maps and Waze. The SUS is a normalized questionnaire designed to assess perceived usability. There are 10 standard questions and each question with five steps anchored with “Strongly Disagree” and “Strongly Agree”. Finding the score contribution for each question, which ranges from 0 to 4, is the first stage in scoring a SUS. The scale position minus one is the score contribution for items with positive wording (odd numbers). The score contribution for items with negative wording (even numbers) is 5 minus the scale position. The total SUS score is calculated by multiplying the sum of the item score contributions by 2.5. This generates a value that can vary in 2.5-point increments from 0 (very poor perceived usability) to 100 (great perceived usability).

2.2 Preparation of SUS

10 standardized SUS questions are made in Google Form. 10 questions for Google Maps and Waze are made and the total questions are 20. 10 respondents are required to answer all the questions given in the Google Form. Figure 1. shows the SUS standardized questions and their responses from 10 respondents.

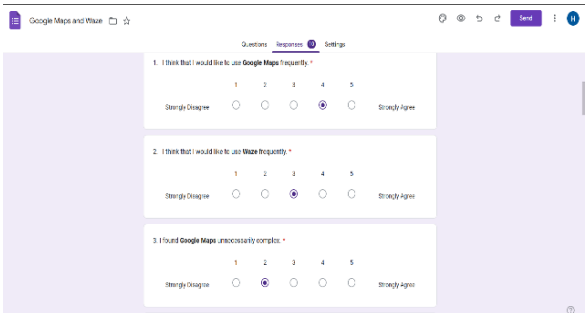

Figure 1. .SUS standardized questions

2.3 Determination of SUS score

The SUS score is calculated by using System Usability Scale Analysis Toolkit. It's an open-source web-based toolkit for the analysis of multivariable SUS studies developed by Mixality Research Group. First, the result of each question is keyed in into the Raw SUS Data. Figure 2. shows the raw SUS data entry.

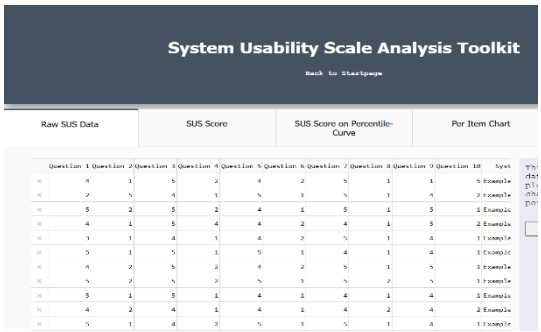

Figure 2. Raw SUS data entry

Complete analysis is generated after data entry is complete. The results of data entry are calculated into a single 0 – 100 score called the SUS score. Then, the toolkit provides a compilation of useful insights and contextualization approaches based on finding from the scientific literature for the SUS questionnaire.

3 RESULTS AND DISCUSSION

3.1 Results

Table 1. shows the SUS score based on the questions. This score is used to calculate mean, median, percentile and standard deviation.

Table 1. SUS scores based on the questions

Variable	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10
Google Maps Contribution (SD)	8.25 (2.97)	7.25 (3.25)	8.0 (2.92)	8.25 (2.97)	6.75 (3.17)	7.25 (2.84)	8.25 (3.17)	6.75 (2.02)	8.25 (2.97)	6.5 (3.0)
Waze Contribution (SD)	5.25 (3.25)	6.5 (2.29)	7.5 (1.94)	7.5 (2.74)	7.25 (1.75)	5.75 (2.75)	6.5 (2.29)	4.5 (2.69)	6.0 (3.0)	6.0 (3.0)

Table 2. represents the table of statistical results. Google Maps has higher SUS score (mean) than Waze. SD represents standard deviation. This column indicates the SD of the SUS scores and provides insights into how consistent or diverse the usability perceptions were for each variable. Google Maps has higher consistency in terms of usability perceptions score by respondents.

Table 2. Statistical results of the usability scores

Variable	SUS score (mean)	SD	Min.	Max.	Quartile	Industry Benchmark
Google Maps	77.5	26.22	10	100	71.25	Above Average
Waze	62.75	16.09	40	90	48.75	Below Average

Min represents the minimum SUS score observed for each variable and maximum SUS score for each variable. The quartile indicates the value that marks the 75th percentile of the SUS scores. Google Maps has higher scores at quartile than Waze. Finally, there is an industry benchmark. This column provides a reference point for comparison, allowing us to evaluate the usability of the navigation applications against industry standard or norm. Based on the table, Google Maps is above average while the Waze is below average.

Figure 3. Below shows the main plot of Google Maps and Waze based on the SUS score.

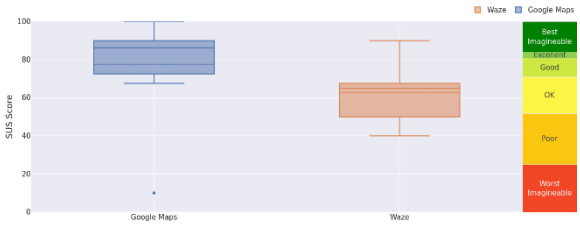

Figure 3. Main plot

Figure 4. represents the percentile of both mobile applications. Google Maps has a higher percentile 80.45 than Waze 33.78.

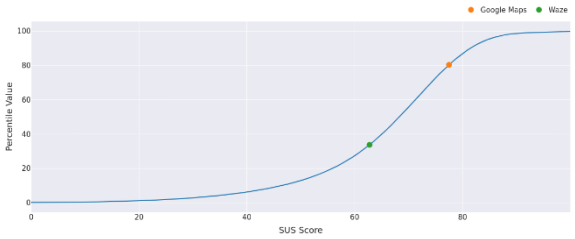

Figure 4. Percentile value based on SUS score

Figure 5. shows the conclusiveness percentage of SUS score. Both applications share the same value of conclusiveness 80%.

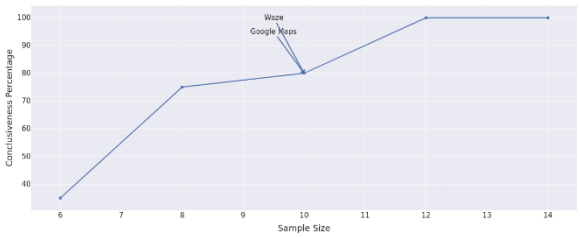

Figure 5. Conclusiveness percentage

3.2 Discussion

The two most widely used navigation apps are Google Maps and Waze. Google Maps began using Google Live Traffic in 2007 and has since been utilized to assist the optimization of the route calculation to prevent 2011 traffic jam. Floating Car Information (FCD) for Waze uses smartphones to create real-time traffic. data. Users are permitted to report traffic dangers like accidents and speed traps, and exchange information about traffic. Immediately add additional highways using the Waze app. By way of a Waze user who has registered before using the software will be provided with a distinct ID and cookie that will serve as identifier while information is being distributed. Based on the results of the SUS score, it shows respondents prefer to use Google Maps rather than Waze. The reason is as the number of road casualties still showing increment recent years in Malaysia, a lot of traffic dangers and accidents being reported in Waze and make it choose other possible road to avoid traffic jam. This also makes Waze users feel frustrated as the road always changes during their way to destination. Sometimes the road shows in Waze are confusing as too many conjunctions.

The second reason Malaysian prefers use Google Maps is that it has more information about destinations, covers more mode of transport and work offline. It also works on desktop and mobile.

4 CONCLUSION

The purpose of this study was to evaluate the two most widely used navigation apps, Waze and Google Maps, which have different methods. The study case also looked at how consistently consumers used the navigation system. This case carried out the study in two stages. Subjective rating was the focus of the first phase, and an experiment-based study was the second.

The findings, however, should be interpreted and generalized with caution since the data analysed in this study were mainly collected in Malaysia with only 10 respondents particularly in Kuala Lumpur and Negeri Sembilan. When discussing usability, it is important to distinguish between the goals and practices of summative and formative usability. Following the summative conception, a product is usable when people can use it for its intended purpose effectively, efficiently, and with a feeling of satisfaction. Following the formative conception, the presence of usability depends on the absence of usability problems.

5 REFERENCES

[1] J. R. Lewis, MeasuringU, and J. Sauro, “Item Benchmarks for the System Usability Scale,” *Journal of Usability Studies*, vol. 13, no. 3, pp. 158–167, May 2018.

[2] T. Jeske, Institute for Security in Distributed Applications, and Hamburg University of Technology, “Floating Car Data from Smartphones: What Google and Waze Know About You and How Hackers Can Control Traffic,” journal-article, 2012.

[3] Z. M. Jawi *et al.*, “Developed Nation in 2020: Malaysia’s Road Safety and Modernization Threats,” Jan. 2013. doi: 10.13140/RG.2.1.2121.9282.

[4] R. Ma and D. B. Kaber, “Situation awareness and driving performance in a simulated navigation task,” *Ergonomics*, vol. 50, no. 8, pp. 1351–1364, Jun. 2007, doi: 10.1080/00140130701318913.

[5] J. R. Lewis, MeasuringU, and IBM Corporation, “Usability: Lessons Learned ... and Yet to Be Learned,” Taylor & Francis Group, journal-article, 2014. doi: 10.1080/10447318.2014.930311.

[6] J. R. Lewis, MeasuringU, J. Sauro, and MeasuringU, “USABILITY AND USER EXPERIENCE: DESIGN AND EVALUATION,” in *USABILITY AND USER EXPERIENCE: DESIGN AND EVALUATION*, 2021, pp. 972–975. doi: 10.1002/9781119636113.ch38.

[7] N. K. Madar and SCE Engineering College, “Navigating through creativity and innovation paths: Waze navigation application case study,” 2021.

[8] J. P. Roque E Santos and S. Silva Mammana, “Navigation Apps Influence on traffic,” 2019.

[9] M. Nasyiah, B. Kelana, and A. Riskinato, “System Usability Scale for Measuring Usability of Social Network Applications from User Perspectives,” *E3S Web of Conferences*, vol. 483, p. 03010, Jan. 2024, doi: 10.1051/e3sconf/202448303010.

[10] “Determining What Individual SUS Scores Mean: Adding an Adjective Rating Scale,” May 2009.