An Empirical Study to Evaluate the Usability of a Food Delivery Application Using HCI Framework

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Abstract—Quick Food is a convenient way of using a hybrid human-computer interaction (HCI) framework of cognitive usability UX approach that provides a comprehensive platform for customers to quickly and easily access a wide variety of food items for purchase. Evaluating user-product interaction involves combining expert insights and user preferences through a hybrid human-computer interaction (HCI) framework for enhanced outcomes in terms of the usability of a software product. The motivation behind our research stems from the concept of incorporating both expert and user perspectives to explore how they diverge or converge in assessing website usability and user experience. This inspires us to delve into the integration of these two parties within our study's scope. The existing research gap in usability and user experience assessment arises from the absence of combining expert and user data studies, often concentrating solely on one-sided viewpoints, typically through a heuristic approach. To address this limitation, we introduced a data-driven assessment measure derived from a cognitive walkthrough. We then compared the results with user data about the domain's specific context. Our data-driven hybrid HCI framework categorizes user survey responses into control, engagement, and goal domains, alongside computing context-level data (C1 to C7) via cognitive walkthrough. We validate user satisfaction and usability perceptions by contrasting these context-level user data with expert thresholds. Furthermore, user comments are analyzed concerning software design parameters to assess user experience levels. In terms of a data-driven hybrid HCI framework, this paper outperforms by incorporating evaluations from both user and expert levels while providing valuable insights into usability and user experience.

Index Terms—Food Delivery Application, Software, HCI, Usability, Hybrid Framework.

I. INTRODUCTION

Quick Food offers its consumers a comprehensive platform through which they can quickly and easily access a wide variety of items for purchase. The website of Quick Food is designed to assist clients in narrowing down their expansive ideas and giving them the ability to finish those ideas. The introduction of meal delivery services over the Internet is the most recent development in this industry. Following in their footsteps are three other businesses that have entered the online meal delivery service industry. The demand for food purchased online is reliant on the accessibility and use of the internet. The proliferation of internet users in Bangladesh over the last five to seven years has significantly affected the country's thriving e-commerce industry. In addition to Quick Food, other local businesses in the area provide similar services; the local food delivery system also gets famous very fast using their big offer of more attractive discounts, which got more customers. We have started to overview the main types of food-grade particulate delivery systems, then we talk about how we currently understand the relationships between the structural and functional characteristics of particulate delivery systems, and finally, we talk about the crucial factors that need to be further addressed in the relationship between structure and functionality [1]. Particulate delivery systems can be made using a variety of production techniques, with the choice of technique depending on the nature of the raw materials and the desired functional performance needed in the delivery system. Overall, the production technique had significant effects on the knowledge needed for its correct application.

The survey technique we used to collect our data was cognitive. Cognitive mapping visualizes a person's or group's mental model of a process or notion. This method would describe individuals or groups. Data collection through analysis and pattern identification might be used throughout user research. Cognitive data might help simplify complex research difficulties, prioritize future research, and clarify abstract notions. Cognitive mapping requires users to data a process.

These businesses allow clients to place orders online from restaurants with whom they have partnered, as well as pay for their orders online and then deliver their food. Because of this, the most fundamental platform for clients to use to make purchases via these sites is online.

1) We surveyed users for their Quick Food website experience and needs, aiming to enhance usability and understand demands.
2) The questionnaire pinpoints system flaws from users' viewpoint, offering clarity on areas for system improvement.
3) This approach aids website development and aligns Quick Food with user needs, fostering platform expansion.
4) We contributed by creating a prototype reflecting user perspectives on Quick Food, informed by ongoing survey findings.

The paper is structured as follows: **Section II** details the earlier research on various systems. The research approach for our proposed framework is presented in **Section III**. Our suggested system's experimental results are discussed in **Section IV**. Finally, the conclusion of this study is depicted in **section V**

II. RELATED RESEARCH

Kathleen Griesbach et al. explored in her paper how food delivery platforms govern employees and how much they restrict gig workers' schedules and activities. Based on in-depth interviews with 55 food delivery platform workers and a survey of 955 platform food delivery workers, they found that while all platforms utilize algorithmic management to allocate and grade labor, there was substantial heterogeneity amongst platforms. However, this data-driven approach did not incorporate any HCI framework. [2].

Mayila Maimaiti et al. in this paper, described how rapid economic expansion and urbanization had transformed China. This trend affected the food sector and eating habits, which increased diet-related non-communicable diseases, overweight, and obesity (NCDs). Online-to-offline (O2O) meal delivery in China had changed food shopping habits, another trend to watch. E-commerce and internet growth have changed buying habits. Over 20 of China's population used online food delivery. This paper examined the new industry's effects on food, health, and society [3].

Vincent Cheo Sern Yeo et al. in this study, examined customer experiences with a few online food delivery (OFD) services. Most have examined consumer attitudes regarding online services/retailing. This research examined the structural link between convenience motivation, post-usage usefulness, hedonic motivation, price-saving orientation, time-saving orientation, previous online purchase experience, customer attitude, and behavioral intention toward OFD services. The paper presents a Contingency Framework and Extended Model of IT Continuance-based integrative theoretical research model [4].

Chuanpeng Wang et al. used Meituan as the research object, apply the ECSI structure model, established a Meituan take-away satisfaction evaluation model based on three first-level indicators of perceived hardware quality, perceived software quality, and perceived service quality, and used SPSS to obtain results. Food delivery, dependability, and satisfaction were analyzed descriptively. It may assist take-out platforms and businesses in understanding the service level and current deficiencies of catering take-out providers to formulate effective remedies to increase client satisfaction. Then This article evaluated Meituan's customer satisfaction with a questionnaire survey and determined it's marginally satisfying [5].

In this research paper by Grant Williams et al. Uber, Airbnb, and TaskRabbit outline their experiences of attracting consumer attention over the past decade. These applications' peer-to-peer commercial exchange has helped resource-constrained societies create social capital and rise economically. To solve these issues, this article examined crowd input in Sharing Economy app ecosystems. They provided a meal delivery app ecosystem case study they presented and intrinsically assessed an automated method for producing a short model of these issues. Their effort begins to identify user demands in Sharing Economy app ecosystems [6].

Christina-Edina Domoks et al. in their research paper on Netfood software. Netfood was food delivery order management software. It was a delivery-focused system that lets customers order from many restaurants at once, either individually or in groups. Users might order online. Administrators oversee the restaurant, food, and order data. Delivery staff utilized smartphone apps. A central server feeds both client apps. The article describes software system design and implementation. Described ware development technology, techniques, and methodologies [7].

Fauziyah Sjahroeddin et al. this study evaluated E-S-Qual and food quality to improve online food delivery satisfaction and value (OFD). SEM modeling was evaluated using data from 405 Bandung OFD customers. SmartPLS 3.0 analyzed data, models, and hypotheses. This study showed that OFD service is primarily based on food quality. OFD service providers must maintain e-service quality to meet consumer expectations, even though food quality is most important. Fulfillment contributes most to consumer satisfaction and perceived value in OFD service. This study recommended OFD service providers to maximize food quality and meet customer expectations [8].

Arghya Ray et al. tried to find the behavior (FDAs & CFDs)and user experience of food delivery apps. The food delivery system impacts people's lifestyle. People can order their favorite food from home, so they can order anytime and from anywhere. All the food companies and food chains ware trying to connect into one place, they increase their home delivery system and their revenue was generated increasingly. The rate of FDA was very critical in this study. The limitation of this study was searching it only depends on FDA users inside India. They can't control the quality of this study [9].

Sushant Kumar et al. followed up on how the food delivery system helps people during a COVID-19 pandemic. People of every age depend on food delivery apps and companies. They attracted customers through their services, app design, reliable services, and trustworthy facilities. During the pandemic, the world economy kind of stops suddenly. People can't go outside, but the food is necessary to live, So the food companies and delivery companies meet their best service and generate good revenues. The limitation of this service was safety and health issues also the emotional impact of the app is very important [10].

G. Fancello et al. were trying to find a solution to the versatile food delivery chain system. There were problems with transport to many cities, So the author tried to find Online food delivery platforms to accept new people to find the user experience needs better than others. The author found that the small town has more facilities to deliver food faster than the large city because the big city has population problems. The review said that more advantage is found in food delivery to fresh food, roadside, own vehicle, and many more. The problem found that big cities need to improve decision-making and limit solutions by following the strategies of small cities following the rules [11].
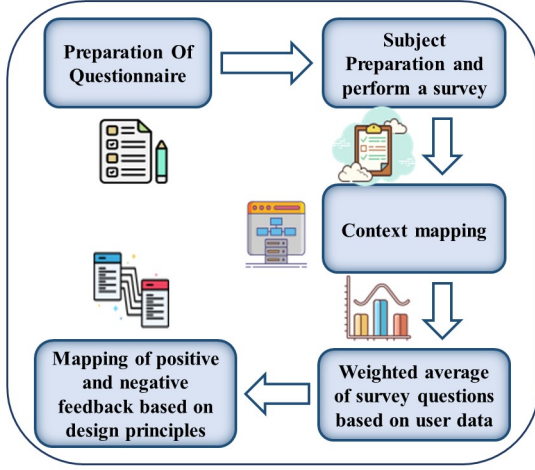
Fig. 1: Our Proposed Hybrid Framework

III. METHODOLOGY DIAGRAM DESCRIPTION

On an online based platform, it is important to determine what a user wants to see on the first page of the website. It can differ on various platforms, and the first page must be attractive enough to hold the user's attention while fulfilling their purpose of visiting the website. In an online food-delivery system, a user usually wants to see their desired delicious food on the home page. Then, various categories of foods must be included so the consumer can easily search and find their desired meal and an ordered system that will help them in purchasing food online. The system overview of our proposed framework is shown in this figure Fig. 1.

A. System Architecture

Quick Food a Bangladesh is the place to shop. Quick Food, an online meal delivery service, offers a comprehensive selection of the best restaurants and local favorites in your region to help you satisfy your appetite. Since Quick Food is an online platform, it's important to know what users expect to see on the homepage. A user typically wants their most exciting food on the main page since it's an online meal delivery system. Subsections for various food categories follow in Fig: 2 and their descriptions are given below:

The homepage features diverse restaurant ads and tempting food discounts for seamless navigation. Casual browsing is login-free, but user authentication is required for purchases and saving favorites. Account setup is easy with email or phone, offering convenient online updates within a secure storage system. The ordering process includes dish selection, SMS confirmation, and flexible payment options, including COD. User data privacy is a top priority. After confirmation, users eagerly await delivery, ensuring a satisfying experience.

B. Preparation of questionnaire

To assess the effectiveness of our online food delivery system, we've crafted a detailed questionnaire aimed at gathering valuable user feedback to enhance our website. This questionnaire comprises twelve questions that gauge users' experiences when using the Quick Food platform. These questions encompass a wide range of factors, including reliability, performance, user interface/user experience (UI/UX), and the efficiency of the web interface. Furthermore, we've incorporated inquiries to gauge user satisfaction regarding interface quality, online payment processes, and design tools. We eagerly anticipate utilizing the insights gained from these survey questions to refine and improve our website. The survey questions are described below in Table 1.

TABLE I: Survey Questions Collected from Users

Q1	How would you like to rate the flexibility of interaction parameters while using the Online Food Delivery (QuickFood) platform?
Q2	How would you like to rate the Online Food Delivery (QuickFood) platform on the basis of navigation through the site?
Q3	How would you like to rate the Online Food Delivery (QuickFood) website on the basis of unavoidable interruptions?
Q4	How would you like to rate the user-friendliness of the Online Food Delivery (QuickFood) site interface?
Q5	How would you like to remark on the visual layout of the interface to be based on a real-world metaphor parameter while using the Online Food Delivery (QuickFood) site?
Q6	How would you like to rate the reliability of the website while using the Online Food Delivery (QuickFood) platform?
Q7	How would you like to rate the website on the basis of finding your desired foods?
Q8	How would you like to rate the Quality of foods/services of this platform?
Q9	How would you like to rate the Online Food Delivery (QuickFood) site on the basis of data privacy while ordering food online?
Q10	How would you rate this site on the parameters of accomplishing your intended purpose of using an Online Food Delivery (Quick-Food) platform?
Q11	Did you have to ask for help to understand how to use the system?
Q12	How would you like to remark on the food ordering environment, artificial or realistic?

C. Perform a survey:

The first step of performing a survey is to make a questionnaire. Previously we prepared a questionnaire, provided it to our users, and asked them to give us their opinions. The idea behind using a questionnaire survey is that learning about usability issues in a system is best achieved by asking users. Their main advantage is that they are inexpensive and relatively easy to use. Then we listed the provided data in a table and calculated the average of the responses answered by restricting them to a range (1-5) where this range represents the satisfaction level of users.

1) Evaluate usability and UX: Towards evaluating a UI and UX evaluation framework based on cognitive and usability. Visualizations help externalize knowledge and aid cognitive processing by refining thoughts and capturing complex ideas. They're useful for explaining features or onboarding new team members. Visuals also reveal common themes in various concepts. In our Design Ops research, participants created cognitive maps of their company's structures, identifying shared characteristics across teams. Cognitive mapping is crucial
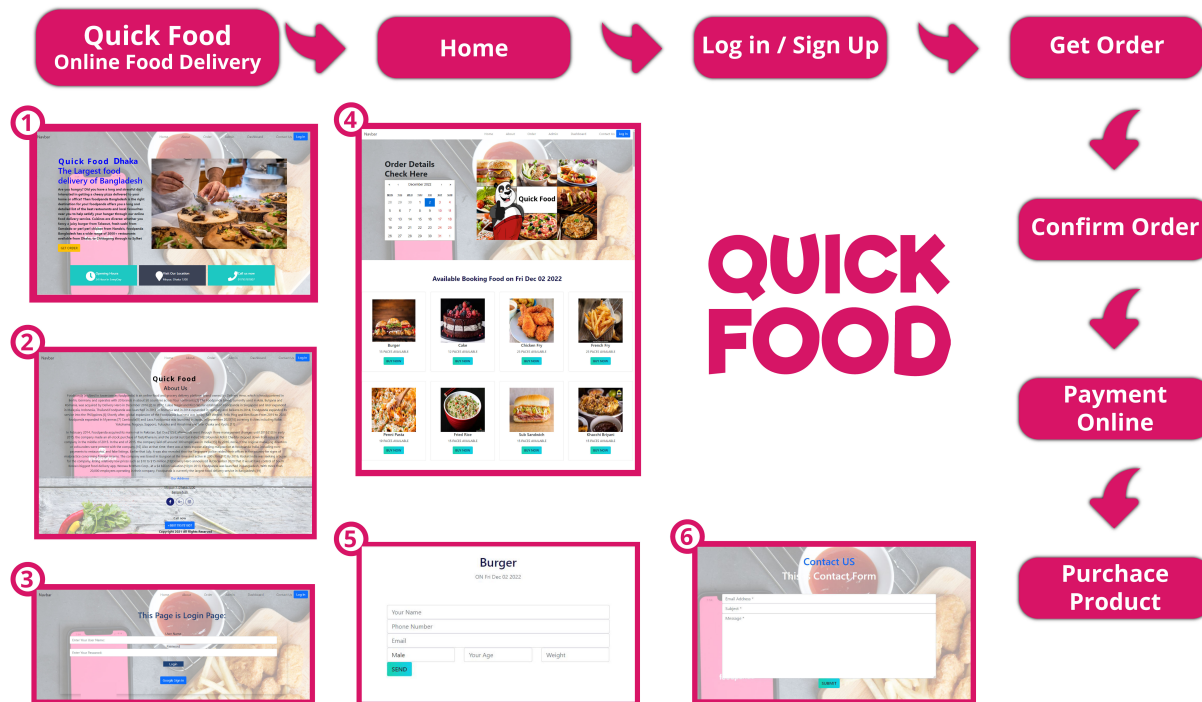
Fig. 2: Our Developed Web Application System Architecture

for understanding user mental models, especially in complex systems or new product designs. This involves individual interviews where participants create visual representations of their thoughts, facilitating discussions and guiding the design process through categorized maps.

2) Cognitive approach: Cognitive mapping is a valuable tool for visualizing an individual's or group's mental model of a process or concept, which can also be applied effectively to our Quick Food online delivery system. This method allows us to map users' and groups' thought processes and perceptions, aiding in comprehensive user research. Through the entire research process, from data collection to analysis and pattern recognition, cognitive mapping proves to be an invaluable resource. In the context of our Quick Food system, a cognitive map can serve to simplify intricate research challenges, prioritize future research initiatives. During cognitive mapping sessions tailored to our platform, participants are encouraged to construct a visual representation of their understanding of the Quick Food process and user interactions. These cognitive maps serve as insightful representations of users' mental models, shedding light on their expectations, preferences, and navigation pathways within our system.

Cognitive mapping visually depicts a participant's thought process for a certain problem or circumstance. It is a useful approach for discovery-based, "messy" user research because of the following qualities:

- **Flexible format:** Cognitive mapping is far less structured than other research methods, including formal interviews, qualitative surveys, and usability testing. The open-ended approach encourages participants to contribute anything they feel is relevant to the current conversation. People may move about using this tactic, which may expose their underlying tendencies and thought processes.
- **Paper trail of the session:** During cognitive mapping sessions, every topic that is discussed is noted down. Thanks to this paper trail, the interviewer and participant have visual cues to concentrate on during the conversation. The participant may add more detail by alluding to earlier concepts and connecting them with the current conversation. Since the participant's ideas are arranged visually on a "map," the facilitator can make references to earlier ideas in the discussion by using the participant's exact words.
- **Value to the participant:** Participants often leave the session with a new understanding of the domain because they had to externalize existing knowledge in a visual, tangible way. By questioning how topics link together and determining where random chunks of ideas fit in, they better grasp the concept at hand.
- **Rich multimedia data:** Cognitive mapping during interviews generates several data sources for analysis: The participant's artifact, written and recorded text, and a film

of its creation are provided.

D. Context mapping

We conducted a user survey with seven categorized contexts aligning with three questionnaire domains. This data-driven analysis, crucial for our new cognitive walkthrough, is summarized in Table II, mapping the cognitive approach to questionnaire domains. For instance, in context C1 (AC domain), averaging questions Q1, Q3, Q7, and Q11 resulted in 4.16. As illustrated in the subsequent chart, we extended this calculation across contexts C2 to C7 (IE OG).

TABLE II: Table For Context Mapping

Context	Questions	Category
C1	[Q1,Q3,Q7,Q11]	AC
C2	[Q2,Q4,Q5,Q6,Q12]	IE
C3	[Q8,Q9,Q10]	OG
C4	[Q1,Q3,Q7,Q11], [Q2,Q4,Q5,Q6,Q12]	AC &IE
C5	[Q1,Q3,Q7,Q11], [Q8,Q9,Q10]	AC & OG
C6	[Q2,Q4,Q5,Q6,Q12], [Q8,Q9,Q10]	IE & OG
C7	[Q1,Q3,Q7,Q11], [Q2,Q4,Q5,Q6,Q12], [Q8,Q9,Q10]	AC, IE & OG

E. Weighted average of survey questions based on user data:

We got some results on various questions by doing this survey. Here, we have completed our survey based on twelve questions. Based on this survey, we got the weights Q1 297, Q2 292, Q3 283, Q4 289, Q5 285, Q6 288, Q7 289, Q8 291, Q9 289, Q10 289, Q11 279, and Q12 282. This time, the questions were divided into different categories.

F. Mapping of positive and negative feedback based on design principles:

At the time of performing the survey, we gave the option to the user to send us feedback. All the participants shared their opinions about the online food delivery system and suggested improving where they found it lacking.

IV. IMPLEMENTATION

In this survey review graph, we can see that the results are based on cuisine. Whereas for Highly Satisfied, Satisfied, Neutral, Dissatisfied, and Highly Dissatisfied, the average value is calculated based on each value, which is graphed in the integrated form of Table III.

In fig. 3 describes a user survey with questions categorized into seven contexts aligned with three questionnaire domains. This data-driven analysis is essential for a new cognitive walk-through. An example in context C1 demonstrates the calculation of averages. Total and average values for contexts C2 to C7 are subsequently computed.

In fig: 4, The findings are used to create a spiral chart by first calculating the cosine value depending on the data that we have. Our questionnaire, which consisted of a total of twelve questions, is now finished. According to the results of this survey, The chart is being developed. The questionnaire

TABLE III: Table for functional-level questions in terms of user Feedback

Question	HS(5)	Satisfied (4)	Neutral (3)	Dissatisfied (2)	HD (1)
Q1	31	29	8	1	0
Q2	24	37	8	0	0
Q3	28	24	13	4	0
Q4	24	35	9	1	0
Q5	26	27	15	1	0
Q6	29	25	14	0	1
Q7	29	25	14	1	0
Q8	27	30	12	0	0
Q9	29	25	14	1	0
Q10	26	30	13	0	0
Q11	25	23	20	1	0
Q12	24	28	16	1	0

Fig. 3: Context scores in different mapping categories

results, displayed in a spiral chart, represent distinct data collection sections for each of the twelve survey questions. After concluding data collection, we calculated relative mean values, considering all relevant factors in constructing the chart.

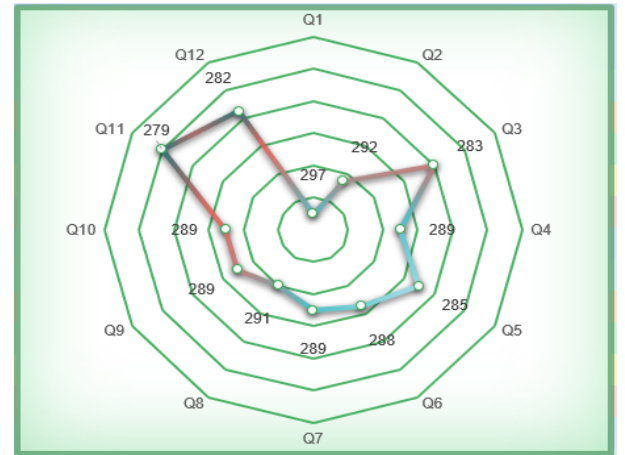- **Reliability:** Positive feedback regarding reliability was

Fig. 4: The summarized scores of each individual question.

TABLE IV: The highlighted positive and negative feedback from the users of online food delivery system in terms of its services

SL	Design Performance	Keyword	Selected Users Comments
01	Reliability	(P) ordering online	(P) Reliability is good.
02	UI and Ux	(N) more eye-catchy (N) more flexible frame & UI, UX	(N) The design should be more eye-catchy. (N) More flexible and Try to better UX.
03	Added Login	(N) login	(N) A user login panel is needed.
04	Satisfaction	(P) satisfied (P) daily life easy	(P) Overall a good thing to explore. (P) Highly satisfied. It makes daily life easy!
05	Improve Tracking System	(N) improve GPS (N) need tracing food system	(N) I really struggle with the location system or GPS. (N) Need a system for live tracking food delivery.
06	Performance	(P) best delivery platform (P) save time	(P) Quick-food is the best online food delivery platform. (P) I order food online. It saves us time.
07	Others	(N) Fast Delivery	(N) Make Fast Delivery.

received, highlighting the management team's accessibility.

- **Satisfaction:** One of the design criteria for satisfaction is the user's level of satisfaction parameter.
- **Tracking System:** When it comes to the tracking system, we find negative feedback in comments, like users struggling with the location system or GPS.
- **Performance:** Performance parameters evaluate software usability and functionality.

TABLE V: Mapping Of Context Based User with cognitive evaluation-based experts

Context	Domain	Agg. Score Expert Mean	Fluctation Level [4.00]	Fluctuation Notation	User Satisfied or Not
C1	Action & Control	4.16	0.16	(P)	X
C2	Interaction & Engagement	4.16	0.16	(P)	X
C3	Outcome & Goal	4.20	0.20	(P)	X
C4	Action & Control & Interaction & Engagement	4.16	0.16	(P)	X
C5	Action & Control & Outcome & Goal	4.18	0.18	(P)	X
C6	Interaction & Engagement & Outcome & Goal	4.18	0.18	(P)	X
C7	Action & Control, Interaction & Engagement & Outcome & Goal	4.17	0.17	(P)	X

In Table V, Our data-driven HCI framework categorizes user survey responses into three domains: control, engagement, and goals. To validate user satisfaction and usability, we compare user data in each context (C1 to C7) with expert opinions. User comments are assessed within the software design parameters, with all contexts surpassing the expert mean score of 4.00, ensuring a minimum level of usability

V. CONCLUSION

This article comprehensively assessed the usability and user experience of an online food delivery service website in Bangladesh. We used a hybrid HCI framework, which combined user studies and cognitive walkthrough processes, allowing us to measure user satisfaction quantitatively. We compared user-level and expert-level data to identify discrepancies. Our study addresses the current challenges and opportunities in Bangladesh's online food delivery service industry. We pinpointed issues and their root causes and integrated market research findings to propose improvements. The contrast between user and expert perspectives yielded valuable insights for enhancing our UI and UX design. While the main goal was to assess our hybrid HCI framework's effectiveness, our study also contributed by consolidating various usability and user experience criteria in HCI research. Future research could explore comparative analyses of online food delivery services, possibly spanning different cities, to establish a universal hybrid HCI framework for evaluating usability and user experience aspects.

REFERENCES

[1] Whaiduzzaman, Md, Adnan Sakib, Nisha Jaman Khan, Sudipto Chaki, Labiba Shahrier, Sudipto Ghosh, Md Saifur Rahman et al. "Concept to Reality: An Integrated Approach to Testing Software User Interfaces." Applied Sciences 13, no. 21 (2023): 11997.
[2] Griesbach, Kathleen, Adam Reich, Luke Elliott-Negri, and Ruth Milkman. "Algorithmic control in platform food delivery work." Socius 5 (2019): 2378023119870041.
[3] Maimaiti, Mayila, Xueyin Zhao, Menghan Jia, Yuan Ru, and Shankuan Zhu. "How we eat determines what we become: opportunities and challenges brought by food delivery industry in a changing world in China." European journal of clinical nutrition 72, no. 9 (2018): 1282-1286.
[4] Yeo, Vincent Cheow Sern, See-Kwong Goh, and Sajad Rezaei. "Consumer experiences, attitude and behavioral intention toward online food delivery (OFD) services." Journal of Retailing and Consumer services 35 (2017): 150-162.
[5] Wang, Chuanpeng. "Customer Satisfaction Evaluation of Food Delivery Platforms-Taking Meituan as an Example." In 2020 International Conference on Big Data Economy and Information Management (BDEIM), pp. 124-127. IEEE, 2020.
[6] Williams, Grant, Miroslav Tushev, Fahimeh Ebrahimi, and Anas Mahmoud. "Modeling user concerns in sharing economy: the case of food delivery apps." Automated Software Engineering 27 (2020): 229-263.
[7] Domokos, Cristina-Edina, Barna Sera, Károly Simon, Lajos Kovács, and Tas-Béla Szakács. "Netfood: A Software System for Food Ordering and Delivery." In 2018 IEEE 16th International Symposium on Intelligent Systems and Informatics (SISY), pp. 000143-000148. IEEE, 2018.
[8] Sjahroeddin, Fauziyah. "The role of ES-Qual and food quality on customer satisfaction in online food delivery service." In Prosiding Industrial Research Workshop and National Seminar, vol. 9, pp. 551-558. 2018.
[9] Ray, Arghya, Amandeep Dhir, Pradip Kumar Bala, and Puneet Kaur. "Why do people use food delivery apps (FDA)? A uses and gratification theory perspective." Journal of retailing and consumer services 51 (2019): 221-230.
[10] Kumar, Sushant, and Arunima Shah. "Revisiting food delivery apps during COVID-19 pandemic? Investigating the role of emotions." Journal of Retailing and Consumer Services 62 (2021): 102595.
[11] Fancello, Gianfranco, Daniela Paddeu, and Paolo Fadda. "Investigating last food mile deliveries: A case study approach to identify needs of food delivery demand." Research in transportation economics 65 (2017): 56-66.