

Improving cultural awareness and trust towards m-banking apps in Jordan

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ABSTRACT

Today's mobile technology is improving our quality of life and changing our lifestyles by providing mobile financial applications that allow us to conduct daily financial transactions anytime and anywhere. As the number of mobile applications increases, great customer training offers innovative solutions suited to different customers' cultures. Although Jordanian society has limited use of mobile banking applications due to a weak level of cultural awareness among consumers and financial security risks. Hence, we propose a culture-aware trust-based assistant to facilitate mobile banking transactions. It leverages the potential of guidance and behavior controllers to enhance awareness about available banking services while increasing confidence levels between Jordanians users for mobile apps. Particularly, an effective monitoring strategy and customer behavior controller aims to reduce fraud in mobile banking apps. An 18-user empirical study confirms that the completeness of financial culture and trust impact the customer's attention to mobile banking apps. Therefore, the proposed assistant reaching an average interaction time of 20 seconds while achieving a high confidence rate of 74.05% which validates its efficacy and practicability.

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1. INTRODUCTION

Jordan has never overlooked the development of its banking sector, and it introduced the principles of mobile technology, thriving business, prosperous life, and effective financial services to its clients [1]. The continuous advancement of mobile technology and artificial intelligence (AI) has correspondingly propelled the transformation and development of the banking sector [2]. The banking sector encompasses new effective strategic decisions while promoting banking performance [3]. In this context, Jordan strongly advocates and supports the digital mobile services, leading to a gradual increase in the number of mobile banking applications and rapid growth of the business [4], generating positive economic benefits for the country. Among the well-known mobile applications in Jordan are Jordan Mobile Payment (JoMoPay) [5], eFAWATEERcom [6], and Zain Cash [7]. However, mobile banking has suffered some usage problems. While people's awareness of using mobile banking has improved to some extent, various factors continue to prevent its spread. These include shallow financial data protection awareness, decreased number of customers who conducted their financial transactions through mobile banking (only 8%), and poor cultural

awareness [8]. Overall, 79% of customers believed that they could complete their financial tasks without using mobile banking, and the majority of customers expressed their need of cultural awareness and confidence to use mobile applications in their daily financial transactions [8]. Since cultural awareness and trust form the basis for promoting mobile banking development, it is imperative to prioritize financial data protection in tandem with the development of digital mobile technology [9]. Besides, if the banking sector in Jordan still maintains the old business culture before using mobile applications, it will inevitably face customer reluctance, leading to a decreased number of users using mobile applications [10]. Neglecting cultural awareness and privacy often leads to unauthorized access to financial data, a lack of trust, and disruption of mobile banking.

Central Bank of Jordan (CBJ) is renowned for its diverse banking services, and rich financial facilities, including investments and payments facilities, making it a prominent bank in Jordan and providing a solid foundation for promoting cultural awareness and trust [11]. Nevertheless, it struggles with cybersecurity challenges and emerging threats such as unauthorized access to sensitive data, poor customer culture, increasing attack surfaces, valuables loss, and disruption of banking services. The improvement of cultural awareness and trust towards mobile banking is complex in CBJ [11]. While academic research focuses on bridging the gap between mobile banking and cultural awareness [12]–[25], there are few studies focused on the CBJ strategy. Some consideration of deductive approach can help adopting mobile payment systems (EPS) to improve the electronic payment system (EPS) in Jordan [24]. In particular, Ghaith and Ghaith [20] rebuilt the banking sector in Jordan to accept digital transactions, including credit facilities and bank transfers. They focused on how Jordanians understand and use electronic payments and purchasing services. Existing studies have not explicitly examined the lack of financial awareness and trust and how they impact mobile app security (i.e., privacy policies to understand, how financial data is collected, used, and shared as well as how to gain trustworthy access to financial data). Bringing cultural significance and including privacy control mechanisms into mobile apps can enhance trust and attract more customers. A user-friendly interface is one of the solutions to making mobile banking apps easiest to use and spread more culture use between Jordanian customers [19].

This paper proposes a culture-aware trust-based assistant for mobile banking, aimed at facilitating mobile banking improvement. It leverages user-friendly interfaces, cultural guidelines, and privacy controls to offer customers great opportunities to access various mobile services and enhance their overall experience. It proposes strategic guidelines-based culture-aware trust service recommender and customer behavior controller via a mobile banking app. Our main motivation is to increase opportunities to benefit from rich mobile facilities provided by banks through secure mobile applications and to perform so with the highest confidence and speed. The following research questions are addressed in this paper:

RQ1: how does culture awareness improve the usability of m-banking services and users' attention?

RQ2: how assistant strategy can increase users' trust and engagement in mobile banking?

RQ3: are users inclined to support our proposed assistant as a useful tool in their mobile services?

We summarize the contributions of this study as: i) we introduce a culture-aware trust-based assistance approach to suggest interactions guidelines to ensure usability of mobile banking services in trust and safe manner; ii) to illustrate the capabilities of the proposed approach, we exemplify the proposed approach in the context m-banking redesign, enabling it to improve user interface usability and enhance customer experiences; and iii) through comparative experiments enhances the quality of use in both services and products, thereby improving users' perceived ease of use and adoption intentions, we demonstrate the benefits of our assistant in practice by using mobile banking in Jordan. The provision of cultural awareness.

2. METHOD

In banking, cultural awareness refers to delivering quality, effective services to diverse customers. To implement this practice, mobile apps must be customized according to cultural, technological, and behavioral needs. It also requires an understanding of how cultural differences may affect bank services. This drives us to examine the effects of other factors: i) how do customers view the financial services, and facilities provided by banks and financial institutions through secure mobile apps?; ii) how to ensure customers' expectations while providing digital banking services; iii) how to ensure quality service, ease of use, and conviviality regarding user interface design; and iv) how to ensure both customer trust and satisfaction while using mobile applications.

The answers to these questions are not as straightforward as they may seem. Our findings indicate that consumers' preferences for accepting credit and mobile payment through mobile apps are very much culturally dependent. They may use mobile apps for many simple transactions, but for complex services, many surveyed customers want easier interface interactions, trust, and business domain knowledge, even as their needs evolve with social, economic and cultural change. The work aims to explore new ideas for the

growing cultural awareness of bank customers' mobile apps. Further, we developed assistance with banking services offered via mobile apps, along with how they perceive ease of use, trustworthiness, and quality of service.

2.1. Cultural awareness

Our approach is based on bringing mobile banking services with changing cultural and technological trends. Diverse banks strive to provide financial cultural services and improve their reputations. However, banks have the unique opportunity to influence customer behaviors and attitudes of their customers towards accepting credit and e-payment through mobile apps, increasing trust and at the same time strengthening digital banking services. Cultural awareness includes the following concepts:

- Customer's profile: describe the customer's general information (name, address, age, identity, address, and e-mail address). The older and younger customers prefer to visit a branch to receive financial advice. It is beneficial to change these behaviors to engage customers in credit and e-payment on mobile banking apps without visiting a branch to make the transaction.
- Customer's religion: a religious customer does not engage in all banking operations that are tainted by usury and depravity in banking transactions. The bank can improve the cultural awareness of their customers and foster mobile banking apps to customers it is safe and trust about each new product.
- Technology competence: includes customer experience and skills to ensure the usability and efficiency of the mobile banking apps.
- Business knowledge: recognizes the level of customer's knowledge of different financial products and services suited to their current needs based on their transactional and behavioral data. However, customers who have increased their business knowledge can still have drawbacks and unconscious biases about cultural businesses other than their own.
- Social influence: family members and friends can influence behavior. This can, in turn, impact both customers and consumers about trust treatment.

2.2. Banking services quality and customer satisfaction

Banks must disseminate the right cultural awareness of the available financial products and services that the customers can use optimally and safely. In addition, a bank must also expose its financial products and services through quality UI and ease of use across different mobile devices with respect of customer's cultural awareness, high trust level, and good safety. In fact, the customers' experiences reflected their notion of right behaviors vs mobile usage. When banks fail to consider customer cultural awareness, they may inadvertently deliver lower-quality mobile services. Cultivating customers that improve cultural awareness and service interactivity can play a decisive role in the provision of high-quality mobile services. In addition, building mobile applications with bank professionals who reflect the diversity of the customer cultures can also increase a bank's reputation. Diverse factors have a wider influence on the bank's reputation and confidence level when using mobile applications which are described as follows as shown in Figure 1:

- Trust: is the confidence level of using mobile banking services or products. The higher confidence values represent good performance and long life of mobile banking services or products. In addition, ease of use, time-saving, privacy, and security, are also factors for increasing the trust of customers.
- Ease of use: is how easy and simple when using the mobile app. The clarity and suitability of the mobile application to the customer, whether in terms of language, the great design of its UI elements, or the use of it is services in a short time, the more ease of use is present and available.
- Satisfaction: is the relevancy degree between customers' expectations and perceptions of quality-of-service delivery, and the bank's ability to satisfy their needs and wishes. However, the quality of mobile banking from the customers' visions is that which meets their expectations.

2.3. Banking services quality and customer satisfaction

Figure 2 illustrates the proposed mobile app architecture of the culture-aware trust approach, encompassing vital elements like the Mobile app UI, customer service request analysis, participant/attacker, audit log, trust service recommender, and service controller. In the following, we will explore and describe each component:

- Customer: a legal banking customer who has a profile and proper cultural awareness factors. He can request financial services using the mobile app UI anytime and anywhere.
- Attacker: acts as a simulated adversary that deploys malicious actions with mobile applications.
- Mobile app UI: allows banking customers or other users (e.g., attackers) to interact with the bank server, receiving their requests and calling appropriate financial actions.

- Customer service request analysis: is the core component of the mobile banking application responsible for analyzing the nature of the incoming requests. It processes incoming requests, whether they are genuine user actions or deception actions imposed by the mobile app.
- Trust service recommender: is responsible for assisting UI actions for legal customers or deception actions for attackers. The trust service recommender calls the customer assistant or service controller.
- Customer assistant UI: allows guiding the customer to provide him with great banking directions and the tracking of the change of cultural factors (beliefs, attitudes, behaviors, skills, languages, and preferences) of a customer.
- Service controller: serves as an admission control.
- User profile: corresponds to the description of the customer’s cultural awareness factors including customer profile, customer religion, business knowledge, and social influence.
- Whitelisting: defines all persons who have access authorization for the banking services.
- Audit logs: leverages the audit log functionality in mobile app to gain valuable visibility into customer activities. This enables real-time monitoring, proactive security measures, and the increase of culture awareness to maintain a secure and trusted mobile app.

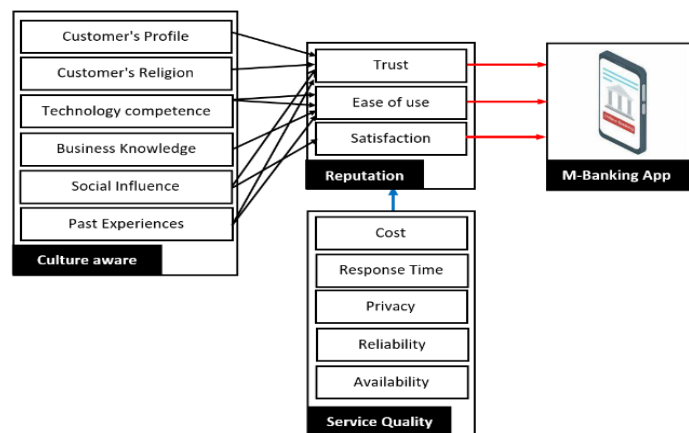


Figure 1. Cultural awareness vs trust, ease of use, and customer satisfaction

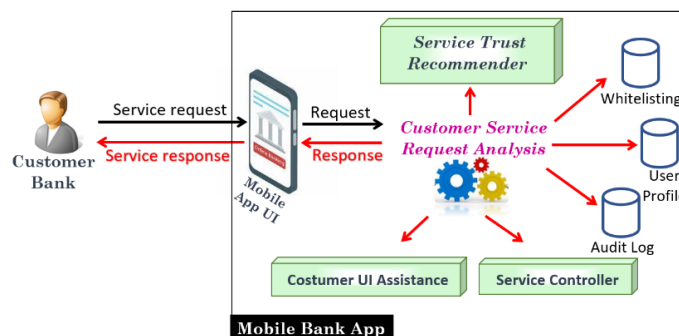


Figure 2. Mobile bank app architectural design

2.4. Culture-aware trust based guiding strategy

The guiding strategy is designed to effectively increase customer culture and trust regarding mobile banking apps by mitigating malicious actions within the mobile app. As illustrated in Figure 3, the legal customer and potential attackers connect to the banking mobile application and request the banking services that want to make (e-payment, credit, and finance) or request malicious actions. These requests pass through the customer service request analysis, which is responsible for intercepting requests aimed at the bank server. Upon intercepting the requests, the customer service request analysis applies to check actions based on the predefined logic of the mobile app. The trust service recommender then proceeds to execute the appropriate

security measures, if necessary, before forwarding the modified requests to the banking server. The trust service recommender is the core component of the mobile application responsible for executing requested actions. It processes incoming requests, whether they are guiding customer actions or deception attackers. The customer UI assistant then proceeds to modify UI based on the cultural information of the customer and difficulties then monitoring the customer in their actions. By monitoring the customer actions, we create a robust defense mechanism that proactively intercepts, and addresses potential security threats and makes the services safely and efficiently to guide customers use right transactions based on monitoring of the customer actions. In the next subsection, we will see the type of guiding actions and the proposition of a culture-aware assistant algorithm.

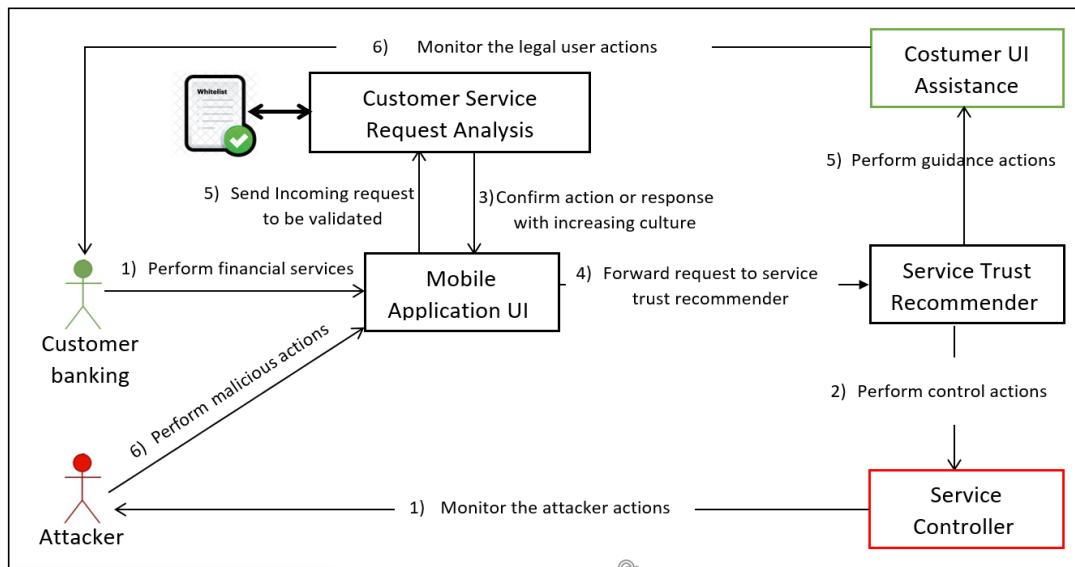


Figure 3. Functional model of the proposed approach

2.4.1. Customer UI assistance

In the proposed secure mobile banking application, UI assistance can monitor customer activities using audit logs. By generating comprehensive audit logs for all activities, the mobile app enhances cultures and provides valuable insights into potential security attacks such as e-payment, accidents, and banking service availability. In our work, the most important types of assistance are: i) develop a plan based on competence skills; ii) govern the privileges and permissions associated with data access; iii) provide potential information on attacks; iv) consider the relevant cultural factors when addressing an attack; and v) consider the appropriate skills for the attack response.

2.4.2. Relationship between customer’s culture and service trust

The concept of trust is an important feature related to the customer’s culture and quality of service. The trust is calculated using (1):

$$trust = (ease_of_use + reliability + confidentiality)/customer_culture \tag{1}$$

The trust increases with ease of use, reliability, and confidentiality of services. The higher the trust, the more interaction there is between the customer and the service’s UI. Strong customer understanding means high trust.

2.5. Culture-aware trust assistance algorithm

The level of the intention of the present customer c_1 to user interface mobile banking services can be determined by using (2), based on the similarity among customers.

$$Score = \alpha \times Sim_{cust-experience}(E_{c1}, E_{c2}, S) (1 - \alpha) \times Sim_{cust-culture}(C_{c1}, C_{c2}, S) \tag{2}$$

where the score relies on the customer's previous experiences and cultural awareness of user interface mobile banking services (S), $Sim_{cust-experience}(E_{c1}, E_{c2})$ and $Sim_{cust-culture}(C_{c1}, C_{c2})$ and α is used as a weight.

3. RESULTS AND DISCUSSION

The goal of our experiments is to assess the usefulness of the culture-aware trust assistant, as we involve participants with diverse experiences and cultures in m-banking. Particularly we responded to the three research questions defined in section 1.

Culture-aware trust-based assistance algorithm

Inputs: K : number of mobile banking service

N : number of user interfaces for mobile banking service

M : number of interaction modes for user interface service

Outputs: Result UI: the final score for each mobile banking service

Begin

1: Group user interface services by mobile banking service

2: **For** $i=1$ to K do

3: **For** $j=1$ to N do

4: **For** $l=1$ to M do

5: calculate_culture_score (M_l, S_j);

6: calculate_experience_score (M_l, S_j);

7: calculate_score (M_l, S_j)

8: **End For**

9: **End For**

10: **End For**

11: Result UI=Find maximum score for user interface mobile banking service

12: **Return** Result UI

End

3.1. Experimental design

Participants were tasked with conducting banking services on the mobile application based on their skills and confidence levels. The mobile application provides a total of 4 main banking services in a safe, easy, and secure manner. To be more specific, the mobile application consists of customer account information, scheduling services, e-payment, ordering products, and invoice management and payment. During these experiments, the customer will use four user interfaces: customer assistance, billing, recommendation, and decision-making. The experiments use guidance including interaction facilities, safety instructions, trust m-payments, and authorization options. This guidance investigates the influence of cultural awareness and trustees of participants when performing mobile banking.

3.2. Data collection

We aim to investigate the influence of cultural awareness and trust on user mobile attention, utilizing the proposed recommendation approach. For every research question as described in section 1, the following data are collected: perceived ease of use, perceived service trust, and reliability. These metrics aimed to test participants' skills and confidence in exploiting their competence in conducting banking services on the mobile application.

3.3. Participants

A total of 18 participants were recruited using different cultures and skills sampling. Each participant was provided with access to a mobile application UI, which was hosted on a mobile device, through a secure proxy connection. This secure proxy allowed participants to remotely access their bank account and perform transactions within the bank server. Most participants (12/18) performed the financial actions immediately, while others (6/18) began searching locally and got untrusted in the mobile financial services that assigned attacks located in different locations. Moreover, some participants (9/18) mentioned their experience with mobile devices, and all participants acknowledged varying degrees of interactions or cultures when conducting mobile banking in real-world scenarios. We offered a user interface tailored to the participant's culture. We also applied the principle of informational hints to participants and guided them in enhancing their cultures necessary for completing the financial activities.

3.4. Procedure

The experiment started by obtaining formal consent from each participant, followed by providing them with experimental guidelines. To assist participants with the financial operations of the mobile device, we set up different scenarios and guided them in carrying out all required interactions within a mobile device, including mobile purchasing and payment services. During the experiment, we provided different difficulties (e.g., various attack scenarios) to the participants and presented them with efficiency and effective objectives. Initially, participants will use a bank account limited to specific financial tasks such as consulting only accounts and transferring money on predefined account names. Additionally, participants were asked to perform complex financial tasks. Once they completed all tasks, they were asked to rate the guidance and interaction guidelines provided by the proposed assistant. Throughout the process, their behavior towards mobile applications is monitored and recorded. At the end of the study, we collected participant's opinions regarding trust and flexibility in interacting using mobile mobile applications.

3.5. Results analysis

In our study, different experimental scenarios were employed to analyze cultural awareness and trust using mobile financial applications, and each subject was evaluated using one measurement.

3.5.1. Results of research question 1

In order to investigate whether different users' cultures would affect m-banking use, we evaluated the proposed assistant on different mobile services. Figure 4 shows the execution time comparisons to perform financial tasks on the mobile application. We can see that the execution time in the proposed approach is about 20 s with full customer culture. However, the proposed approach outperforms the work [8] significantly in execution time, showing that comprehensive assistance to financial actions leads to greater interaction facilities and easier engagement in performing mobile financial services than the use of annotations. Since the proposed assistant offers guidance for interacting with culture-aware mobile financial services.

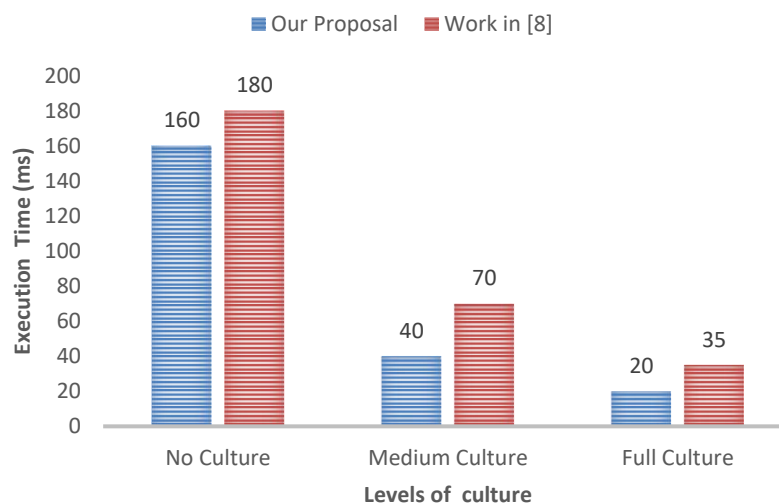


Figure 4. Comparison of response time under different customer's cultures

3.5.2. Results of research question 2

User trust is an essential aspect of the proposed assistant. It is based on assisting users to avoid fraudulent advertisements with great purchase prices. Once the user logs into the mobile application, he can buy apartments, and land plots, or perform other banking services. To increase users' trust towards mobile services, the proposed approach guides them through all stages of the purchasing process by i) verifying the advertisement and its source; ii) checking the attacker's identity and network; iii) sharing the request directly with the owner through a secure mobile application; and iv) contacting the bank to obtain authorization to conduct credit and balance checks.

To investigate whether the assistant strategy would affect the trust level, deceived participants into fraudulent purchases of land or a ready-made apartment. Figure 5 shows users' trust comparisons with the related approach [8] to perform financial tasks within the mobile app. The proposed approach archived about 75% of perceived service trust. Compared to the related approach [8], users can rely on the guidance of the proposed assistant to directly escape from fraudulent purchases and perform more investment actions with higher trust and better quality.



Figure 5. Comparison of perceived service risks and trust under different attacks

3.5.3. Results of research question 3

The proposed approach is compared with the related approach [8] in terms of full security and trust aspects, transparency, improvement of customer culture, and automatic fraud detection. Table 1 shows the comparison of our mobile apps with the related approach [8]. It is apparent that the proposed approach can not only fulfill the basic requirements of the customer but also shows superior performance in terms of behavior control and trust degree. Due to the reliability of our assistant, we can dedicate the reliability of the proposed mobile system to handle all categories of banks: local, national, and international. In the future, the applicability of the system will require further evaluation.

Table 1. Related work [8] vs proposed assistant

Assessment criteria	Related approach [8]	Proposed approach
Security and trust	X	✓
Transparency	X	✓
Enhancement of customer culture	X	✓
Automatic fraud detection	X	✓

3.6. Discussion

The proposed approach provides a culture-aware assistant for all customers to enhance user experience in mobile banking apps. With the aid of such assistance, users can exploit new guidance and control solutions to enhance their trust toward accepting mobile banking by providing user-friendly mobile services and meeting security needs. A notable benefit of incorporating cultural awareness and trust into mobile banking lies in its capability to recommend control directives while also improving the experiences behind the suggestions. This enables users to well understand the effectiveness of mobile banking services with more culture awareness, increasing their trust and confidence with financial services.

Experimental results show that the provision of cultural awareness enhances the quality of recommendations in both services and produces, thereby improving the user-friendliness perceived by users and the adoption of mobile application. Additionally, different forms of conveying UI also impact the diversity and persuasiveness of mobile services. Therefore, the proposed assistant reaching an average interaction time of 20 seconds while achieving a high confidence rate of 74.05% which validates its efficacy

and practicability. Compared to conventional approaches [1], the proposed approach is more user-friendly, as users can conduct banking transactions with the help of a culture-aware trust-based assistant. The results are more diverse, ensuring more flexibility in decision-making. Furthermore, mobile environments enable users to perform more financial actions confidently and efficiently.

4. CONCLUSION

The research introduces a new approach based on cultural awareness and trust to efficiently manage the financial services of mobile bank apps. The secure service recommendation and behavior control are used for developing mobile app data and guiding the financial services adapted to customers. A key objective is to ensure easy-to-use UI and secure services as well as spread more cultural awareness among customers of Jordanian banks about utilizing mobile apps. The presented mobile app was demonstrated using the Jordan Central Bank and evaluated by various scenarios to decide on its suitability and effectiveness. The evaluation of the obtained results was achieved through several metrics such as consumed time and number of customers using a mobile app with confidence. The results obtained are very encouraging and confirm the impact of culture-awareness and trust on users' mobile apps customers by focusing on service security scenarios and ease of use of UI. In the future, we plan to work on several customer profiles that complete our vision of a culture-awareness trust mobile app. We will also perform other experimental evaluations and comparisons with existing methods in the literature.

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