

## A Study on the Impact of Face Recognition Payment System Characteristics and Innovation Resistance on Intention to Use: Focusing on Chinese Users

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**Abstract:** With the arrival of the fourth industrial revolution, new technologies have been applied in many fields. An example is the face recognition technology applied in customs, attendance, payment, and other fields, which greatly improved customer convenience. In the recent years, face recognition technology has been applied in the financial industry, and new face recognition settlement services have emerged. Face recognition payment scans a person's face through a camera, analyzes the eyes, mouth, ears, etc. as face feature points, and compares the extracted data with the stored database to determine whether it is the person. When payment requires identity verification, face recognition is used instead of password input or other verification systems, and this only takes five seconds to complete. The purpose of this study is to successfully diffuse face recognition payment services and investigate resistance to use, giving businesses information to refer to. Therefore, this paper makes an empirical analysis of how the characteristics of settlement system and innovation resistance affect the intention to use. In this study, an empirical analysis was conducted after reviewing previous studies on the characteristics of the financial system, innovation resistance, and intention to use. Based on previous studies, Rephrase.

The characteristics of face recognition payment system includes convenience, reliability, security, and contactless transaction. A survey was conducted among Chinese users and the results were analyzed using Smart PLS 2.0 structural equations. The results of the study are as follows. First, among the features of the face recognition payment system, convenience, reliability, and security have a negative effect on user innovation resistance. Second, among the features of the face recognition payment system, non-contact has a positive impact on user innovation resistance. Third, user innovation resistance has a negative effect on the intention to use.

**Keywords:** face recognition, convenience, reliability, security, non-contact, innovation resistance, intention to use

### 1. Introduction

The beginning of the fourth industrial revolution paved way for the rapid development of big data, artificial intelligence, Internet of Things, cloud computing, block-chain, and other technologies. These emerging and new technologies have been and are being applied in various fields. In particular, the fintech industry, where new technologies are applied, has changed beyond recognition. The emerging financial technology has had a profound impact on the payment industry.

The convenient payment market began in 1998 when an online payment agency service called "PayPal" was launched. Later, with the development of mobile devices, mobile settlement services are divided into two types. One is short-distance settlement, such as identifying QR code or bar code for settlement in physical stores, and the other is online remote settlement. To facilitate convenient payments, there is a growing interest in the Quick Online Identity (Fido) technology, which provides convenience to users by quickly authenticating a consumer's identity in an online environment. For example, when entering personal information on a smart phone, you only need to enter a simple password of a few digits, or pass biometric authentication (fingerprint recognition, face recognition, etc.), easily conduct identity verification, and quickly settle accounts. Subsequently, with the rapid development of smart phones, the mobile easy payment market has grown rapidly. Global mobile settlement has grown from \$45 billion in 2014 to \$108 billion in 2019, according to Statista statistics.

With the development and convergence of technologies such as the Internet of Things and artificial intelligence, a new simple payment service has emerged. Finland launched the world's first face recognition payment system "Uniqu" in 2013. Alibaba's Alipay launched a face-recognition payment system called "Ching-ting" in 2018, and South Korea's Shinhan Bank officially launched its face-recognition payment service in 2019. The era of simple payments by using cameras to recognize faces has begun. Users will no longer be limited to mobile phones. Even if the mobile phone is powered off, they can still identify and complete the payment through the camera of the POS terminal on the face recognition payment system. However, with the development of electronic financial transactions, service providers need to collect a large amount of personal information in order to make the service greatly convenient for users and improve their satisfaction. To use this service, users must agree to the collection of personal information. Therefore, in the era of big data, personal information is more likely to leak. This shows that with the increase in convenience, the risk also increases [1].

Face recognition technology is widely used in all walks of life. Human biological information is widely collected. They often question whether this information can be safely stored, transmitted, and used. Face has its

particularity, and is often exposed to the public environment, and is the only inconvenient to hide and modify. Some people worry that face information will be collected by cameras with face recognition function without their knowledge, thus causing information leakage and bringing huge risks and losses. Therefore, the face recognition payment service is creating a new payment market, but it is not mature enough to be questioned.

In this study, the features of face recognition payment system are divided into convenience, reliability, security, and non-contact. The paper also makes an empirical analysis on the influence of the characteristics of face recognition payment system and innovation resistance on the intention to use. Structural equation model is used to test the relationship between the factors mentioned.

## **2. Theoretical Background**

### **2.1 Face Recognition Technology And Payment System**

Face recognition technology has long been an area of research in the field of pattern recognition and computer vision, as a technology that determines what kind of person a corresponding face is through automatic detection and analysis of a face area for an input still image or video including a face [2]. Face recognition is a kind of identity recognition, which is similar to the ID card recognition, fingerprint recognition, and iris recognition. In the process of face recognition, a camera is used to scan a person's face, and then it is analyzed into face feature points such as eyes, mouth, and ears, and then data is extracted. This is a pattern recognition technology that can compare and judge the extracted data and compare with the stored database [3]. Methods of extracting face features include thermal images and ultraviolet rays, or three-dimensional measurement. Face recognition system uses deep learning algorithm, which greatly improves the accuracy of recognition. Face recognition systems are therefore widely used in medical health, government, and retail. Nowadays, under the influence of the large-scale COVID 19 epidemics, the number of face recognition systems used has also increased, such as face recognition body temperature monitors, face recognition access controls, etc.

It is estimated that the global face recognition market size will increase from \$3.2 billion in 2019 to \$7.9 billion in 2024, with a CAGR of 16.6% [4]. According to statistics from the Prospective Industry Research Institute, the scale of China's face recognition market accounts for about 15% of the global market. In 2018, the market size of China's face recognition industry was 2.51 billion yuan, and the market size will exceed 10 billion yuan by 2024.

To increase the convenience of use, face recognition providers need to collect a large amount of personal information. At present, there is no unified organization and law to regulate the use right, ownership, and other issues of big data. Therefore, the risk of collecting a large amount of personal information in the era of big data is also increasing, which is why people refuse to use facial recognition in making payments. There are two services that are commonly used for payment through face recognition. One is a mobile phone-based payment service called mobile simple payment. It is a payment service that verifies the account using the camera to recognize the owner's face instead of typing in a password to verify the identity upon payment [5]. The other is a payment platform based on the face recognition system, first launched in the Finnish start up "Uniqu" in July 2013. When paying, the customer will just look at the camera on the POS screen. It is necessary to associate the consumer's face information with the personal account in advance. After the system verifies the personal information through face recognition, the payment can be deducted from the associated account, so that the entire transaction process can be completed within five seconds. It is mainly used for offline payments.

### **2.2 Face Recognition Payment System Characteristics**

With the development of smart phones, simple payment methods have also changed. People no longer need wallet, card, and cash, but instead they simply need to have their electronic accounts linked and enter their password whenever making payments. However, there may be risks when smart phones are stolen or passwords are leaked, so in order to ensure the stability of payment, biometric technology has attracted more attention [6].

According to the research on system quality by Delone & McLean (2003), it can be considered that system quality refers to the extent to which users use the system effectively, while convenience, reliability, security, and response speed are factoring that measure system quality [7]. The system quality is an important factor that affects customer satisfaction and intention to use. The face recognition system has the characteristics of non-contact and non-coercion. In this paper, the quality characteristics of the face recognition payment system were selected as convenience, reliability, security, and non-contact.

Face recognition payment systems use face recognition for authentication. If the new payment method is simpler and more convenient than the previous payment method, this will have an important impact on its adoption and acceptance. Convenience has practicality related to use, such as convenient movement, convenient time, convenient operation, and convenient use of learning methods [8]. Choi proposed that the face authentication process can be used for user authentication through the camera of the mobile device without the need for a separate process [9]. Another method can be used for user authentication and payment through the camera of the POS machine without carrying anything, which is very convenient. And since the face is part of the body, it can be used anywhere, anytime, which greatly simplifies the operation process.

The concept of reliability is a conventional concept that has been used in various fields, including general social relationships, and its importance and attention have recently been amplified in the online environment [10]. Reliability refers to the ability of the system to perform the promised service reliably and accurately [11]. Recently, with the development of various new technologies in the era of big data, the explosive growth of big data has made

personal information easily leaked, so reliability has become particularly important [12]. The reliability of the system has an important impact on the satisfaction and use intention of the users.

Security refers to the degree to which users feel about personal information leakage [13]. It defines the degree to which you believe that personal or financial information will be protected without leakage in the process of using new technology [14]. Bae argued that the spread of IoT use would be delayed if security issues that can be issued in the IoT environment are not resolved [15].

Non-contact means that the user can continue to operate while keeping a certain distance from the machine to without physical contact with the machine [16]. In the process of face recognition, the face does not need to have contact with any media to collect the face data through the camera. This non-contact method will cause discomfort and fear to the user. Thus, it is possible that the users of the system would have innovation resistance.

### 2.3 Innovation Resistance

Acceptance of innovation changes the existing way of life, and is accompanied by negative feelings such as fear, uncertainty, doubts, as well as expectations for the changes that innovation will bring [17]. In particular, innovative products to which new technologies are applied in rapidly developing industries such as mobile communication cause endless conflicts in the process of accepting them [18]. Some people believe that innovation resistance is a tendency not to accept innovation, and it is a normal reaction of a specific individual when facing new changes. This resistance to innovation stems from the uncertainty and fear of new changes [19]. When S. Ram studied the innovation resistance model, he proposed that innovation resistance is not the opposite concept of acceptance, but a natural attitude experienced by users in the process of acceptance, which is a negative behavior that refuses to change the current state.

### 2.4 Intention To Use

Intention to use is a psychological decision made when an innovative product or service feels convenient, easy to use, and useful [20]. In other words, it can be defined as the possibility of using products or services in the future. In addition, according to previous studies, it was argued that personal characteristics, social characteristics, product characteristics, and corporate characteristics influence the intention to use fintech services [21].

## 3. Research Model And Research Hypothesis

### 3.1 Research Model

From the viewpoint that the features of the face recognition payment system will have a great influence on the customer's intention to use, the features of the face recognition payment system, convenience, reliability, security, and non-contact were selected as variables. This paper empirically studies the factors contributing to the tolerance of customers and their intention to use the face recognition payment system. For this, a research model as shown in [Fig. 1] was designed.

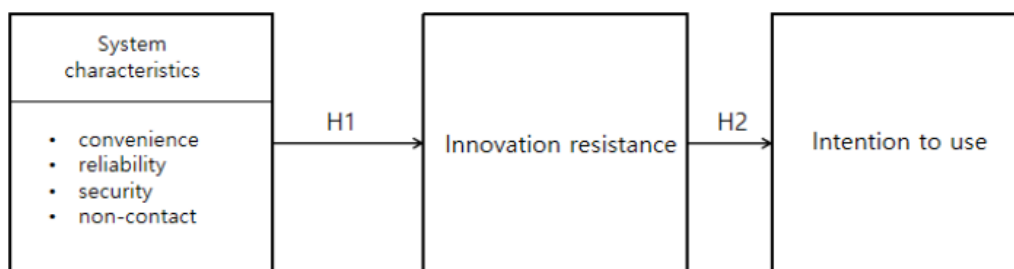


Fig.1 Research model

### 3.2 Research Hypothesis

**3.2.1 Characteristics Of Face Recognition Payment System And Innovation Resistance:** Delone & Mclean has established an Information System Success Model (IS) [9]. They believed that information characteristics and system characteristics will affect customers' intention and satisfaction. They take convenience, safety, reliability, stability, and response speed as the characteristic factors of the system. Jang proposed in the research that face recognition has non-contact characteristics [22]. Referring to previous studies, this paper chooses the features of face recognition payment system as the factor of consumer innovation resistance. The following hypotheses were established.

H1-1: Among the features of the face recognition payment system, convenience has a negative (-) effect on innovation resistance.

H1-2: Among the features of the face recognition payment system, reliability has a negative (-) effect on innovation resistance.

H1-3: Among the features of the face recognition payment system, security has a negative (-) effect on innovation resistance.

H1-4: Among the features of the face recognition payment system, non-contact has a positive (+) effect on innovation resistance.

### 3.2.2 Innovation Resistance And Intention To Use:

According to Ram et al., innovation resistance is a kind of uncertainty, manifested as uncertainty, and doubt about novelty. They believed that innovation resistance has an important influence on the communication and use intention of innovation.

The new technology itself is innovative, and users will cause many changes when they use it. The uncertainty of change and the suspicion of change can lead to resistance to the diffusion of innovative products. Innovation resistance makes users refuse to accept new technologies and generate resistance [23]. The hypothesis below was established.

H2: Innovation resistance has a negative (-) effect on the intention to use.

**3.2.3 Operational Definition And Measurement Of Variables:**

To analyze the characteristics of the face recognition payment system, a structural model based on previous studies was applied. A questionnaire was used which contains 6 concepts and 17 questions including convenience, reliability, safety, non-contact, innovation resistance, and use intention. Each key concept varies from each question, which is answerable by a five-point Likert scale.

Convenience means the method of using the service is simpler and more convenient than the existing one. Three questions were designed to investigate convenience.

Reliability refers to the degree of trust in the face recognition payment service system or the company providing it. This article designs three questions to investigate reliability.

Security means the system can protect the information and privacy of individual transactions. This article designs three questions to investigate security.

Non-contact means face information can be obtained without contact between the user and the machine. This article designs two questions to investigate non-contact.

Innovation resistance is a psychological resistance, such as refusal to accept or stop using it. This article designs three questions to investigate non-contact.

Intention to use is the degree to which you want to use the face recognition payment service. This article designs three questions to investigate intention to use.

Table I. Operational Definition and Measurement Items

Variables		Details	Prior study
Face recognition payment system characteristic	Convenience	-You can easily use face recognition payment service. -The process of using the face recognition payment service is simpler than the existing method. -Face recognition payment service is not affected by time or region.	[7]
	Reliability	-It is reliable to use face recognition payment service. -The quality of the face recognition payment service is reliable. -A company that provides face recognition payment services is reliable.	[24]
	Security	-I am concerned about the leakage of face data information. -I am worried that face data information will be used without my knowledge. -I am worried about receiving external threats such as hacking personal information.	[7]
	Non-contact	-When paying, I am worried about paying without contact with the machine. -Face information is exposed without contact.	
Innovation resistance		-I am against the use of face recognition payment systems. -I am reluctant to use the face recognition payment system. -I have a fear of using the face recognition payment system.	[25]

Intention to use	-I am willing to use face recognition payment service. -I am willing to continue to use face recognition payment service. -I am willing to use various face recognition payments if possible.	[7]
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**4. Empirical Analysis**

**4.1 Data Collection**

This research conducted an empirical analysis through questionnaires. The questionnaire survey method is to conduct an online survey in cooperation with a Chinese survey service company.

The survey was conducted on Chinese consumers. The survey started on August 19, 2020, lasted for 21 days, and distributed 198 copies. In the survey, males accounted for 46.46%, females accounted for 53.54%, and the 20-29 age group accounted for the largest proportion, accounting for 43.94%. Undergraduates with education level accounted for 82.83%, and students accounted for 40.91%. Most studies on the intention of adopting innovative technology products were generally accepted by young consumers. Therefore, this analysis is mainly for those who are 20 to 29 years old with a college degree or above.

Table II. Demographic Characteristics (n=55)

Item		Frequency	Ratio(%)
Gender	Male	92	46.46
	Female	106	53.54
Age	10~19	40	20.20
	20~29	87	43.94
	30~39	56	28.28
	40~49	4	2.02
	Over 50	3	5.45
Education	Below high school	2	1.01
	Graduated from high school	15	7.58
	University graduation	164	82.83
	Master's degree	11	5.56
	PhD or above	6	3.03
Job	Profession	41	20.71
	Self-employment	15	7.58
	White collar	37	18.69
	Student	81	40.91
	Other	24	12.12

**4.2 Data Analysis Method**

This article uses SPSS 22.0 for the basic statistics and the structural equations on Smart PLS 2.0 for the partial least squares. Basically, reliability should be Cronbach's Alpha 0.7 or higher. The validity is divided into concentration validity and discriminant validity. The concentration validity examines the factor loading value, component reliability (CR), and variance extraction index value (AVE) of each factor. In general, the factor loading value is 0.6 or more, the component reliability value is 0.7 or more, and the variance extraction index value is 0.5 or more. As a result of comparing the square root of the variance extraction index value with the correlation coefficient, the variance extraction index value is greater than the vertical and horizontal correlation coefficient values, so there is no problem with the discriminant validity. In this study, before proceeding with structural equation analysis for the reliability and validity analysis of the research model, the measurement model analysis was conducted first as shown in Table III.

Table III. Reliability and Internal Consistency

Variable name		Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
Convenience	CON1	0.926	0.802	0.924	0.876
	CON2	0.934			
	CON3	0.823			
Reliability	RES1	0.923	0.858	0.948	0.917
	RES2	0.946			
	RES3	0.910			

Security	SEC1	0.922	0.865	0.951	0.922
	SEC2	0.942			
	SEC3	0.927			
Non-contact	NOC1	0.906	0.803	0.891	0.756
	NOC2	0.887			
Innovation resistance	INR1	0.933	0.880	0.956	0.932
	INR2	0.959			
	INR3	0.921			
Intention to use	IOU1	0.925	0.838	0.939	0.903
	IOU2	0.940			
	IOU3	0.880			

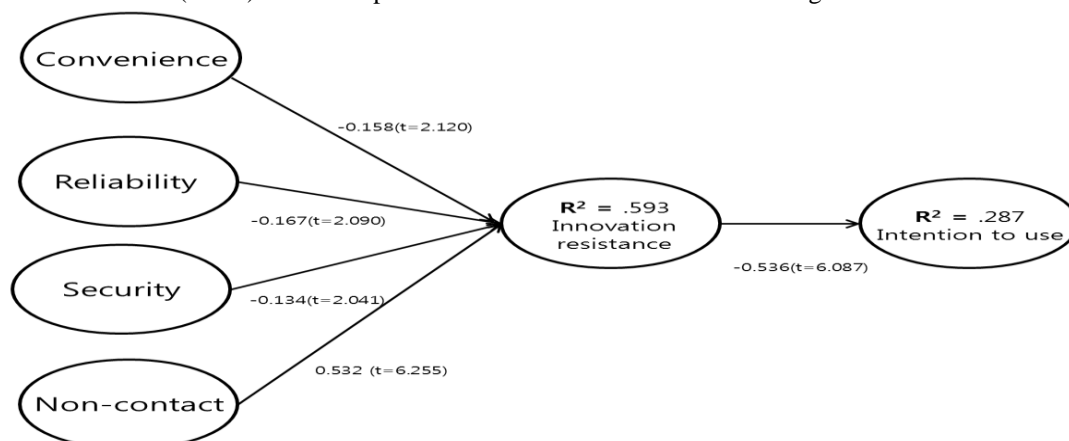
As a result of the analysis, the AVE value of all variables is the correlation of each variable. It is larger than the square, so all variables can be considered to have discriminant validity as shown in Table IV.

Table IV. Correlation and Discriminant Validity

Variable name	AVE	Convenience	Responsibility	Security	Non-contact	Innovation resistance	Intention to use
Convenience	0.802	0.896					
Reliability	0.858	0.814	0.926				
Security	0.865	0.743	0.730	0.930			
Non-contact	0.803	-0.272	-0.285	-0.257	0.896		
Innovation resistance	0.880	-0.537	-0.544	-0.510	0.656	0.938	
Intention to use	0.838	0.807	0.809	0.819	-0.331	-0.536	0.915

4.3 Verification Of The Structural Model

In this study, PLS was adopted as the data analysis method in consideration of the characteristics of the study such as theoretical robustness, the number of samples, and self-development of the questionnaire. If the R<sup>2</sup> value is 0.26 or more, the degree of fitness is high; and if it is 0.26 to 0.13, the degree of fitness is expressed as medium; and if it is less than 0.13, the degree of fitness can be expressed as low. The innovation resistance (0.593) and intention to use (0.287) of the component values can be both evaluated as high. The research result model is shown



in Fig. 2.

Fig. 2 The results of the research model

The model analysis results are as follows.

Hypothesis H1-1 “Among the features of the face recognition payment system, convenience has a negative (-) effect on innovation resistance” was statistically significant at the significance level of 95% (H1-1; β=-0.158, t=2.120, p<0.05). Thus, this hypothesis was adopted. It implies that the higher the convenience of face recognition payment, the lower the innovation resistance.

Hypothesis H1-2 “Among the features of the face recognition payment system, reliability has a negative (-) effect on innovation resistance” was statistically significant at the significance level of 95% (H1-2;  $\beta=-0.167$ ,  $t=2.090$ ,  $p<0.05$ ). Thus, hypothesis H1-2 was adopted, which implies that the higher the reliability of face recognition payment, the lower the innovation resistance.

Hypothesis H1-3 “Among the features of the face recognition payment system, security has a negative (-) effect on innovation resistance” was statistically significant at the significance level of 95% (H1-3;  $\beta=-0.134$ ,  $t=2.041$ ,  $p<0.05$ ). Therefore, the hypothesis H1-3 was adopted, which implies that the higher the security of face recognition payment, the lower the innovation resistance.

Hypothesis H1-4 “Among the features of the face recognition payment system, non-contact has a positive (+) effect on innovation resistance” was statistically significant at the significance level of 95% (H1-4;  $\beta=0.532$ ,  $t=6.255$ ,  $p<0.05$ ), so this was adopted. Among the functions of the face recognition payment system, non-contact is essential to resist innovation, therefore, the higher the non-contact of face recognition payments, the higher the innovation resistance.

Table V. Hypothesis test result summary

	Cause variable	Result variable	Path coefficient	T-value	Result
H1	Convenience	Intention to use	-0.158	2.120	Accept
H2	Reliability	Intention to use	-0.167	2.090	Accept
H3	Security	Intention to use	-0.134	2.041	Accept
H4	Non-contact	Intention to use	0.532	6.255	Accept
H5	Innovation resistance	Intention to use	-0.536	6.087	Accept
t=1.960** (P<0.05)					

**5. Conclusion**

Due to the rapid development of China's face recognition market, this paper studied the intention to use face recognition payment system among Chinese customers. A sample survey was conducted among people of all ages in China to gather a data for the study.

The research results of this paper are as follows.

Hypothesis 1 regarding the characteristics of face recognition payment system and the resistance to innovation was all adopted. In other words, in face recognition payment services, convenience, reliability, and security have a negative (-) effect on innovation resistance, while non-contact has a positive (+) effect on innovation resistance. Hypothesis 2 on innovation resistance and customer intention to use was also adopted. In other words, innovation resistance has a negative (-) effect on customer intention to use.

Based on the results of this study, the following implications can be presented.

First of all, the study found that the convenience, reliability, and security of the face recognition payment system have a negative impact on innovation resistance. In other words, the face recognition payment system is more convenient than the existing payment services. The technology or enterprise provided makes users feel more reliable, or the system makes users feel safer in protecting personal information and transaction information. The innovation resistance will be lower.

Second, from the results, the higher the non-contact of face recognition payment system, the greater the innovation resistance. It turns out that non-contact has a big impact on innovation resistance. Convenient payment services use face recognition technology to simplify authentication. Although the verification time and steps are reduced, it is found that face information can be collected and verified in a non-contact way. As a part of the face that is often exposed in the public environment, it is likely that the face information will also be collected by other illegal cameras in the same non-contact way. In addition, face information is associated with payment accounts, and users are worried that illegal collection of facial information will cause economic losses.

Third, the research results show that innovation resistance has a negative impact on willingness to use. In other words, the higher people have doubts, fears, etc. resistance to emerging technologies or services, the lower their willingness to use these technologies or services.

The limitation of this article is that it only studies the influence of innovation resistance and intention to use from the aspect of system characteristics. According to the Model of Innovation Resistance (Ram, 1987) the factors of innovation resistance are presented in three categories: innovation characteristics, consumer characteristics, and propagation mechanisms. In the future, we will conduct detailed research on factors such as innovation characteristics and consumer characteristics based on the innovation resistance theory.

**References**

- a. M. Kim, D. Son, “The Effect of Privacy and Trust Factors in Fintech Service”, Korea Internet Electronic Commerce Association, (2020), Vol. 20, No. 1, pp. 87-98.

2. Ghosh, Ramkrishna. "An efficient and robust modified RSA based security algorithm in modern cryptography." *Journal of Computer Science Engineering and Information Technology Research (JCSEITR)*, Vol. 6, Issue 2, pp, 15-22.
3. H. Kim, J. Moon, J. Park, "Research Trends for Deep Learning-Based High-Performance Face Recognition Technology", *Electronic Communication Trend Analysis*, (2018), Vol. 33, No. 4, pp. 43-53.
4. Bangar, Ashwini, and Swapnil Shinde. "Study and comparison of cryptographic methods for cloud security." *International Journal of Computer Science Engineering and Information Technology Research (IJCSSEITR)*, Vol. 4, Issue 2, pp, 205-212
5. J. Lee, "Changes in Society According to Facial Recognition Technology", *Magazine of the SAREK*, (2020), Vol. 49, No. 3, pp. 90-91.
6. Yuvraj Singh. "CONCEPTUAL STUDY ON NETWORK SECURITY AND ITS TYPES", *International Journal of General Engineering and Technology (IJGET)*, Vol. 6, Issue 5, pp; 37-42
7. "2020 Face Recognition Industry Research Report", China Information Technology Sheet Transformation Technical Committee.
8. Preeti Patel, "Security of Information with Biometric Applications", *IASET: International Journal of Library & Educational Science (IASET: IJLES)*, Vol. 2, Issue 2, pp, 81-88
9. H. Lee, S. Park, M. Sung, C. Sun, M. Jeong, Y. Park, J. Yun, "A Comparison of User Perceptions of User Interface Security Features within Mobile Easy Payment System", *The HCI Society of Korea*, (2018), pp. 503-511.
10. Ruchir Bhatnagar & Vineet Kumar Birla, "Wi-Fi Security: A Literature Review of Security in Wireless Network", *IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET)*, Vol. 3, Issue 5, pp, 23-30
11. H. Baek, "Status of bio-recognition technology applied to simple payment", *Special Report\_ Special Theme*, (2016), vol. 165, pp. 47~52.
12. Mudassir Khan & Shameemul Haque, "Cyber Security and Ethics on Social Media", *IMPACT: Journal of Modern Developments in Applied Engineering & Technology Research (IMPACT: JMDAETR)* Vol. 1, Issue 2, pp, 51-58
13. M. Choi, S. Song, "A Study on the Influence of System Quality Characteristics of Mobile Payment Service on Discontinuance Intention", *Journal of Korean Social Management*, (2018), Vol. 46, No. 3, pp. 625-640.
14. H. Gao, *A Study on Intention to Use Fintech Service: Focusing on Fintech users in Korea and China*, Doctoral dissertation, Keamyung University, (2019).
15. D. Choi, "Analysis and Suggestion of Smartphone Authentication Scheme using Biometrics", *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, (2017), vol. 8(1), pp. 875~885
16. H. Jang, "A study to Promote Use and Reuse Intention in Electronic Banking Service: Focused on Internet Banking and Mobile Banking", *The Journal of Internet Electronic Commerce Research*, (2009), vol. 9(1), pp. 307~330.
17. H. Kwon, "A Study on Possible Effects of Service Quality in e-Banking and Mobile Banking upon Customer Satisfaction", *Sookmyung Women's University Graduate School of Policy and Industry*, Master Thesis, (2008).
18. G. Chandrika, "Study on Software Reliability and Reliability Testing", *Asia-pacific Journal of Convergent Research Interchange*, Vol.1, No.1, (2015), pp. 7-20.
19. S. Kim & L. Li, "Factors Affecting the Intention to Use of Smart-Phone Banking Service: A Case of Chinese Users", *Journal of the Korea Contents Association*, (2012), vol. 12(11), pp. 303~312.
20. V. Bhavana, "Data Security in Cloud environments", *Asia-pacific Journal of Convergent Research Interchange*, Vol.1, No.4, December (2015), pp. 25-31.
21. J. Bae, "A Study on the Innovation Resistance and Deactivating Factors of Internet of Things (IoT) Services: Focusing on the In-depth Interview Method", *The e-Business Studies*, (2017), vol. 18(2), pp. 289~300
22. Y. Zhang, J. Ma, H. Park, "Factors Affecting the Usage of Face Recognition Payment Service", *Journal of the Korea Contents Association*, (2019), Vol. 19, No. 8, pp. 490-499.
23. J. Shin, S. Lee, "A Study of Intention to Use Wrist-worn Wearable Devices Based on Innovation Resistance Model - Focusing on the Relationship between Innovation Characteristics, Consumer Characteristics, and Innovation Resistance", *Journal of the Korea Contents Association*, (2016), Vol. 16, No. 6, pp. 123-134.
24. S. Yang & H. Shin, "Innovation Resistance of Consumer in Accepting New Technology - With Emphasis on Mobile Phone Touch Interface Technology-", *Design Studies*, (2010), Vol. 23, No. 3, pp.37-52.



25. G. Jang, H. Jang, "The Relationship of Mobile Payment Service Using Value and Innovation Resistance, Continuous Use Intention", *Journal of Digital Contents Society*, (2018), Vol. 19, No. 11, pp. 2203-2210.
26. G. Jeong, "A Study on the Influence of Characteristics of Fin-Tech System on Consumer Acceptance: Focused on Mobile Banking", *Major in Technology Industry Policy*, Doctoral Thesis of Busan University, (2017).
27. Lin-Lin Zhang, Jing Xu, Daim Jung, Tabe Ekouka, Ha-Kyun Kim, "The Effects of Facial Recognition Payment Systems on Intention to Use in China", *Journal of Advanced Researches and Reports*, vol.1, no.1, (2021)
28. H. Jang, "A Study on Personal Authentication Technology Using Multiple Biometrics method", *Dankook University Graduate School*, (2019).
29. Y. Lee & D. Son, "The Effect of Reliability and Innovation Resistance on the Switching Value of Fintech Service", *The Journal of Internet Electronic Commerce Research*, (2019), Vol. 19, No. 6, pp.75-88.
30. J. Lee, "A Study on the Factors Causing the Intention to Use of Fintech-based Mobile Easy Payment Service", *Department of IT Policy Management Graduate School of Soongsil University*, (2017).
31. D. Ha and S. Lee, "Perceived Risk and User Resistance of Mobile Wallet Service", *Entrue Journal of Information Techn*