

Implementing Facial Recognition in Malaysia Point of Sale (POS) System

Koon Zhi Hin Erwin¹, Intan Farahana Binti Kamsin², Zety Marlia Zainal Abidin³, Hemalata Vasudavan⁴

^{1,2}Asia Pacific University of Technology and Innovation, Technology Park Malaysia, Bukit Jalil, Kuala Lumpur, Malaysia.

¹erwinkoon@gmail.com, ²intan.farahana@staffemail.apu.edu.my, ³zety@staffemail.apu.edu.my,

⁴hemalata@staffemail.apu.edu.my

Abstract— In this era, credit cards are one of the most popular and preferred payment method for online banking and making payment transactions. However, this method still lacking in various areas. When making payment in point-of-sale stores, there's no way in authenticating the person using the method of pay wave. Online transactions area also susceptible to confidentiality breaches and fraud. Therefore, the aim of this research is to propose a new method to avoid authentication issue and fraud through facial recognition technology. The proposed method uses web cams and built-in phone cameras to detect and authenticate the user. The target user for this research would be bank users, credit card holders, mobile payment users and customers in POS. To acquire data on for this research, online survey and literature reviews on facial recognition will be conducted. A prototype will be developed and finally recommend it in current POS and payment system to resolve the following issues and providing a more secure way to authenticate users when making payment in POS and in online. For future recommendation, a two-factor authentication can be implemented using additional biometrics such as combining facial structure and iris for a more accurate and secure authentication in validating people.

Index Terms – Biometrics, Facial Recognition, Payment System, Point of Sale, POS

1. Introduction

The traditional method involving the use of PIN and OTP for account-to-account transaction and online transaction is easily compromised by fraudulent organizations today. Fraud detection technologies of today are only able to stop one-twelfth of one percent of all transactions, which still leads to losses of billions of dollars [1]. Due to the uniqueness of each individual, biometric authentication is attracting a great deal of attention. Biometric authentication includes methods such as fingerprint, iris, face, body movements and palm veins [2].

At the same time, with the current new technologies implemented in variety of industries especially in the Fintech industry. The technologies applied in the industry has undergone global upheaval. Based on a research paper from [3], a facial recognition payment system named “Uniqui” was introduced in Finland in 2013 and relies solely on a camera to authenticate users. They simply cast their gaze over to the camera displayed on the POS screen when paying. The consumer's face data is automatically associated with the individual's personal account by the payment system, which

enables the complete transaction to be executed within five seconds. Moreover, facial recognition technology has also gained an amount of popularity in China. Through Tencent's facial information database, “WeiDuoMei” bakery in China has incorporated facial recognition as a method of paying at a physical store [4]. The emergence of face recognition payment service is establishing a new payment sector that is not yet mature and adopted.

Additionally, facial recognition technology will be used in the proposed system to securely validate payment transactions at Malaysian point-of-sale terminals.

2. Literature Review

2.1 Research Domain

2.1.1 Facial Recognition

The term “facial recognition technology” (FRT) refers to a type of artificial intelligence that can recognize a person by digitizing their face, automating the extraction of facial features, and comparing those features to one another. By evaluating a digital snapshot of the subject's face, FRT generates a template for the face. These photographs are able to be retrieved from databases of passports and driver's licenses, as well as from the enormous number of images that have been submitted to social media sites and the internet. [5]. Using measurements, a FRT template is constructed. To verify or identify a person's facial features, measures such as the breadth of their nose and jaw line length, as well as how far apart their eyes are from one other are taken [6]. Facial markers, known as nodal points, are analyzed, and rendered into a template with a unique code [7].

According to [8], with 3-D technology, the accuracy are improved that uses the distinctiveness of skin texture to identify the person. As the face is analyzed, it will compare the template of the target face to exiting photos in a database to locate a potential match. Through combining different techniques for example, 3-D technology and skin texture analysis. It has an edge over other recognition systems as it is not sensitive to expression changes and may have the ability to adjust physical appearance for example, the growth of beard or moustache and it is able output uniform results in terms of race and gender.

Based on [9] research, it stated that FRT can assist in the protection of the general public and the enhancement of national security on multiple fronts. Likewise, FRT can provide

additional information in criminal investigations and courts through analyzing saved faces of wanted criminals, or unknown suspects via CCTV footage [10]. We also can see from the research by [5], which stated that biometric facial recognition technology could aid in the prevention of fraud by better establishing identify for example, identifying individuals with forged driver's licenses. Based on those research, facial recognition is able to detect and verify individuals effortlessly. Therefore, in this research, facial recognition will be implemented to increase the authentication security in POS system.

2.1.2 Point of Sale (POS) System

A point of sale (POS), an essential component of a point of purchase, it is the location where a customer pays for goods or services and may be subjected to sales taxes. POS machines and systems can be in both brick-and-mortar store or online where it is utilized to handle credit and debit card payments. According to [11], there are 7 types of POS systems which are mobile, tablet, online, self-service kiosk, open-source and multichannel. The most common type of POS implemented is terminal POS system which uses hardware and software based and are often included with barcode scanners, cash drawers. This type of POS system can be seen applied in full-service restaurants, retailers, electronic and grocery store.

In addition, POS system offer contactless payments with payment instruments such as e-Wallet (electronic money) and mobile payment using Samsung pay and Apple pay which gives consumer a variety of payment options. Based on a research by [12], speed of a transaction, determined by the amount of time spent at the counter is one of the influential criteria in selecting a payment instrument in POS system.

2.1.3 Facial Recognition in POS

Facial recognition in POS as the name applied means the implementation of facial recognition technology in POS systems. Instead of using other payment methods such as electronic wallets, QR code, cash and credit cards, the facial structure of an individual is used as a payment method where the payment method is linked to the identity of an individual through the identification and verification using FRT [13]. According to [14], China is a global leader in the use of facial recognition in point-of-sale transactions. Additionally, in 2021 China has over 495 million facial recognition payment users. The research also further stated that FRP consisted of 3 steps in China, initiation, validation, and payment confirmation.

It is found that using facial recognition in POS system is faster, more convenient and safer without worrying about leaving phone or cards at home according to [15]. This it is also supported by the research from [14] that it only takes about ten seconds to pay with the user's facial structure makes the face recognition payment method both quick and convenient.

Besides, in the study conducted by [16], users of ATM cards faces drawbacks such as card expiration and losing the card when using POS. In the same study, it is believed that biometric

such as fingerprint can reduce theft and counterfeiting. It has been found that other biometrics other than face was also used for extra security [17]. For example, Liquid Pay identifies customers by their fingerprints and palm veins. Consequently, this research will further apply FRT in POS system to increase the security in the payment transaction process.

2.2 Similar System

2.2.1 Apple Pay

Apple Pay is Apple's mobile payment service in making payments secure and effortless by just using the iPhone. Transactions made via Apple Pay are supported through Near Field Communication (NFC) connection [18]. Apple Pay enable users to store a maximum of 8 debit and credit cards along with vouchers, coupons, train, and plane tickets in the iPhone. This eliminates the use of physical card or ticket to pay for things or for boarding transportation. Users of Apple Pay can validate their purchases by placing their iPhone near a contactless card reader and authenticate using Touch ID. Users of newer version of iPhone can simply utilize the Face ID function to validate the purchase by scanning the user's face instead of using finger to authenticate the purchase [19].

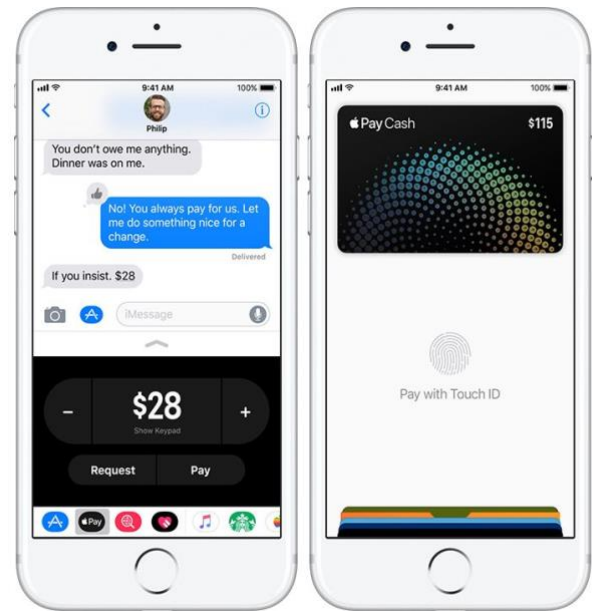


Figure 1: Apple Pay Authenticate Using Touch ID

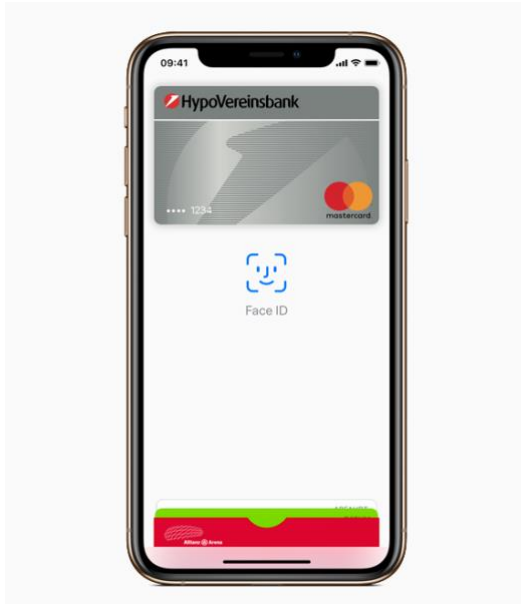


Figure 2: Apple Pay using Face ID

2.2.2 Google Pay

Google Pay is similar like Apple Pay and Samsung Pay which allow customer to buy products and services using an android phone with an NFC chip. It enables consumers to enjoy contactless payment features without always carrying the credit card. Google Pay allow users to add a total of 10 debit or credit card or a PayPal account as a payment [20]. It is able to store passes such as train tickets, boarding passes just like Apple Pay. To use Google Pay, users will need to unlock Google Pay using either PIN, pattern, password, fingerprint, iris scan or 3-D face unlock. This is implemented to secure the information in case the phone is lost or stolen, it is also a means to validate the user to authorize the payment [20].

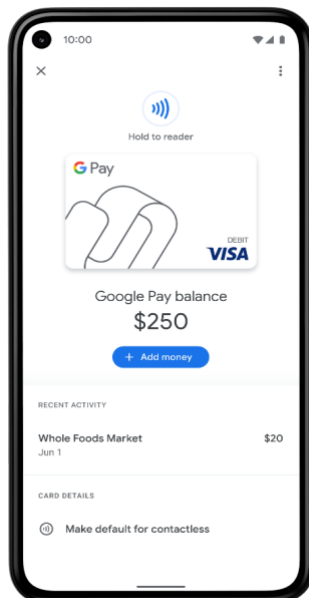


Figure 3: Google Pay

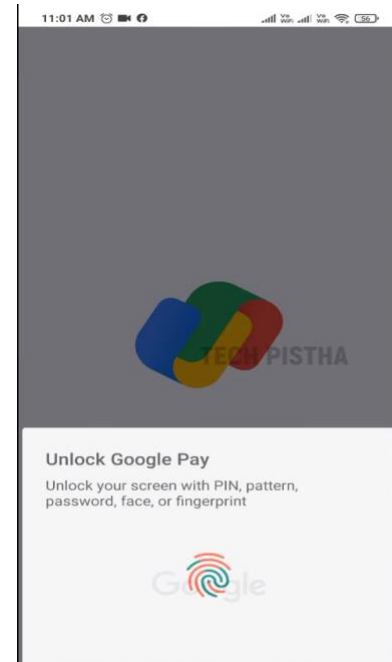


Figure 4: Unlocking Google Pay using PIN, Pattern, Password, Face, or Fingerprint to Authenticate Purchase

2.3 Comparison Table

Similar Systems / Features	Apple Pay	Google Pay	Proposed System
Facial Recognition	Yes	Yes	Yes
Supported in Malaysia POS	Yes	No	Yes
System availability	Mobile	Mobile	Mobile and Terminals
App Payment	Free	Free	Free
Debit, Credit, and Gift Cards	Yes	Yes	Yes
Boarding Passes	Yes	Yes	No
Contactless Payment	Yes	Yes	Yes

Table 1: Comparison Between Apple Pay and Google Pay

3. Problem Statement

As credit cards are widely used throughout the world. People are adopting online transaction such as online bill paying and

online shopping to avoid the hassle of carrying cash. However, the issue of lost or stolen cards, account takeover, fraudulent application, multiple imprints, counterfeit cards and collusive merchants which make online transactions susceptible and did not receive much attention according to [2]. In the event of account takeover, a fraudster clones a victim's credit card through 'skimming' an act of obtaining credit card information and duplicating it on a counterfeit card. The card is then subsequently utilized by the fraudster in counterfeiting. Based on a research conducted by [6], in 2017, there were 1,579 data breaches affecting nearly 179 million records, with credit card fraud being the most prevalent type, accounting for 133,015 reports, followed by employment or tax-related fraud accounting for 82,051 reports, phone fraud accounting for 55,045 reports, and bank fraud accounting for 50,517 reports.

In addition to that, when a customer swipes his or her card at a POS terminal, the transaction information is acquired from the magnetic strips (magstripe) to process the payment. However, this method is insufficiently protected, as information may be easily stolen from the magnetic strips and a new card with the identical information can be cloned and used for transactions. Pins are also susceptible to theft, as is OTP. It becomes relatively easy to make fraud transactions in such situations and if the victims of credit card fraud suffer excessively due to the victim's own mistake the bank does not accept the responsibility for their loss [1]. QR codes that have become another payment method issued by payment companies have clogged up stores and are extremely prone to having their payment address altered. By tampering the QR code it could result in having payer to perform wrong transactions to incorrect receiver and financial loss [2]. In addition, many people opt to use straightforward passwords and to reuse those passwords across a variety of services and accounts, which makes it possible for passwords to be cracked and shared. Additionally, QR payments are closely linked to smart phones, despite the fact that smart phones can be misplaced, have unreliable signals, or run out of battery, rendering individuals unable to use QR for financial transactions. [5]. In conclusion, the problems above faced by point of sale (POS) system could be overcome by implementing facial recognition technology.

4. Research Aims & Objectives

4.1 Aim

This research aims to propose facial recognition technology as a form of payment in Malaysia POS.

4.2 Objectives

- i. To improve the authentication security when making transaction by integrating facial recognition.
- ii. To implement cardless and contactless payment.
- iii. To improve the overall efficiency, performance and accuracy when making payment
- iv. To implement face scanner on POS system using web cam or built-in camera.

5. Research Significance

This research is conducted to bring benefits to two actors which are the consumers and stores with POS system. For consumers, it will benefit them in terms of seamless payment as it is convenient without always having to bring a phone or credit card with them or worrying about losing their card. It also helps in prevent fraud and counterfeit activities through the identification using facial recognition. For stores, it will benefit them by reducing the cost of time due to its fast payment process. Through this implementation, the payment process will be more efficient and effective. Customer experience will increase as they do not need to wait long queues to make payment.

6. Methodology

6.1 Sampling Method

The sampling method used for this research to collect data from a specific group of individuals is stratified sampling since the sample to collect will be in different states in Malaysia. Therefore, with this sampling method the population will be divided into subgroups (strata) where each strata represents a state in Malaysia. Then the respondents from each strata will be selected in a proportionate manner. With this method, it eliminates sampling bias and researcher bias.

6.2 Identify Respondent

The respondent targeted for this research are 130 respondents aged 18 to 55 around Malaysia. This is due to the fact that they are eligible to make a living in the society and capable of owning a bank account tied to them which is a crucial factor when making purchases as well as having the experience in authenticating their purchases via POS system in stores.

6.3 Data Collection Method

The method used in collecting data from the respondents is survey. This method will be suitable for this research as it enables respondent to provide their opinions as well as facts since the questions will be asked in a straightforward manner. Moreover, survey can be conducted to large number of respondents by distributing through online or email. Compared to interview, surveys are more cost-effective and do not consume a lot of time as it does not require travelling.

The survey will consist of a total 10 questions that includes closed ended questions that consists of 5 rating question using Likert scale and the remaining are open ended questions involving 1 speculative, 1 subjective and 3 objective questions. A pilot test will be conducted to evaluate the survey questions before distributing to the respondents. This is to ensure that the questions asked are relevant and will be able to receive valid and reliable response.

7. Overview of the Proposed System

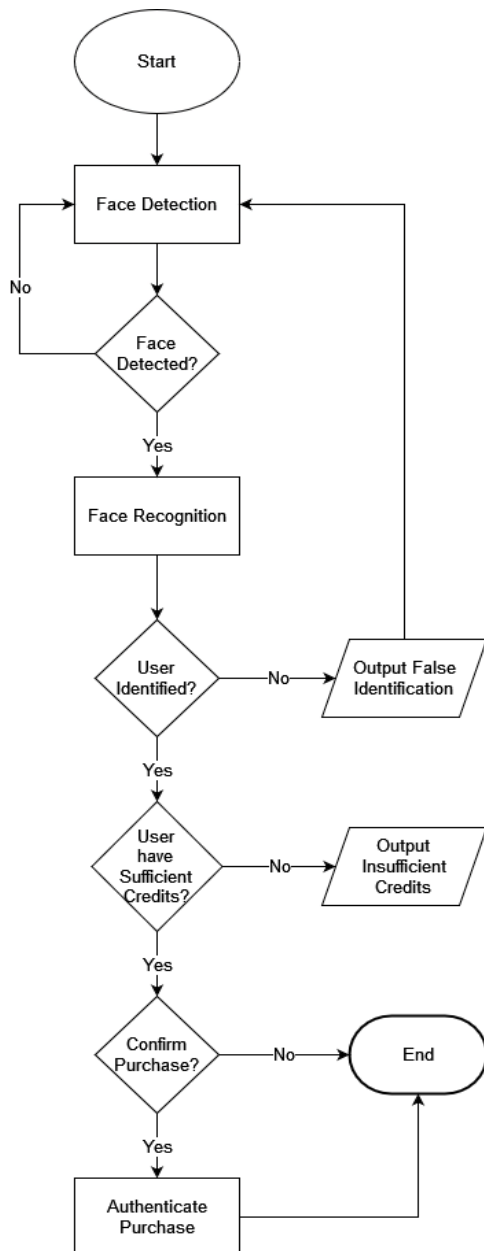


Figure 1: Flowchart for Proposed System

In figure 5, it shows the flowchart for the proposed system implementing the use of FRT technology for POS system in Malaysia. To begin, when a consumer makes a purchase using facial recognition, the point-of-sale system will begin to identify the user's face. This can occur through the built-in camera of a mobile device or tablet, or through an external camera on a POS terminal. The system will then detect the user's face using facial recognition algorithms and proceed to identify the user. The system will redetect the user's face if none is detected. Once the user has been identified, the system will only authenticate the purchase if the credits linked to the user's identity is sufficient for their purchase otherwise the system will just prompt error message and end the system.

While the user has enough credits, the system will authenticate the purchase and deduct credits linked to them and end the process.

As for the face recognition algorithm, it will use Fisherfaces algorithm as it has been reported to have accuracy of 93% according to [21]. This algorithm is available in OpenCV a robust library of tools for image processing operations. Therefore, it will be utilized for this research purpose in the facial detection and recognition process.

8. Conclusion

In conclusion, this research is contributed towards the implementation of facial recognition in Malaysia POS system as a new payment method. The proposed system will enable users to authenticate their purchase without mobile or credit cards thus bringing convenience and secure payment. Moreover, the limitations and gaps in previous research has contributed in this study to strengthen the need of FRT in Malaysia POS system. It noted that there is still a plenty of room for improvements for the proposed system before it is implemented in real world.

9. References

- [1] A. Shiakh, A. Mhadgut, A. Prasad, B. Shinde, and R. Pandita, "CREDIT CARD AUTHENTICATION WITH FACE RECOGNITION USING WEBCAM," *INTERNATIONAL JOURNAL OF RESEARCH IN ELECTRONICS AND COMPUTER ENGINEERING A UNIT OF I2OR*, vol. 6, no. 4, pp. 932–933, Dec. 2018, [Online]. Available: https://www.researchgate.net/profile/Asma-Shaikh-2/publication/338711824_IJRECE_f702/links/5e26bdf3a6fdcc38d24e0608/IJRECE-f702.pdf
- [2] R. Venkatesan *et al.*, "Secure online payment through facial recognition and proxy detection with the help of TripleDES encryption," *Journal of Discrete Mathematical Sciences and Cryptography*, vol. 24, no. 8, pp. 2195–2205, 2021.
- [3] L. Krithika, K. Venkatesh, S. Rathore, and M. H. Kumar, "Facial recognition in education system," 2017, vol. 263, no. 4, p. 042021.
- [4] Q. Anh Tran, "Finnish grocery retailing market assessment for the deployment of payment innovation: Case: Uniqul face recognition payment application," 2016.
- [5] M. Smith and S. Miller, "The ethical application of biometric facial recognition technology," *Ai & Society*, vol. 37, no. 1, pp. 167–175, 2022.
- [6] R. Bhatia, "Biometrics and face recognition techniques," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 3, no. 5, 2013.
- [7] "States Use Facial Recognition Technology to Address License Fraud," *Governing*, Jul. 15, 2015. <https://www.governing.com/archive/states-crack-down-on-drivers-license-fraud2.html> (accessed May 10, 2022).
- [8] M. Mann and M. Smith, "Automated facial recognition technology: Recent developments and approaches to oversight," *University of New South Wales Law Journal*, The, vol. 40, no. 1, pp. 121–145, 2017.
- [9] Bryan Cave Paisner, "Facial Recognition Technology," *JD Supra*, Sep. 11, 2018. <https://www.jdsupra.com/legalnews/facial-recognition-technology-12495/> (accessed May 10, 2022).
- [10] E. McClellan, "Facial Recognition Technology: Balancing the Benefits and Concerns," *J. Bus. & Tech. L.*, vol. 15, p. 363, 2019.
- [11] Freedman Max, "What Types of POS Systems Are There?," *business.com*, Jul. 24, 2021. <https://www.business.com/articles/types-of-pos-systems/> (accessed May 10, 2022).

- [12] M. Polasik, J. Górka, G. Wilczewski, J. Kunkowski, K. Przenajkowska, and N. Tetkowska, "Time efficiency of Point-of-Sale payment methods: Empirical results for cash, cards and mobile payments," 2012, pp. 306–320.
- [13] R. V. Petrescu, "Face recognition as a biometric application," *Journal of Mechatronics and Robotics*, vol. 3, pp. 237–257, 2019.
- [14] W. L. in R.-B. U. Tang, "Revisiting Facial-Recognition Payment: Old Problems Still Lingering," *Nielsen Norman Group*, Mar. 20, 2022. <https://www.nngroup.com/articles/facial-recognition-payment/> (accessed May 11, 2022).
- [15] M. Aria, M. V. Agnihotri, M. A. Rohra, and M. R. Sekhar, "Secure online payment with facial recognition using mtcnn," *International Journal of Applied Engineering Research*, vol. 15, no. 3, pp. 249–252, 2020.
- [16] W. L. Passos, I. M. Quintanilha, and G. M. Araujo, "Real-time deep-learning-based system for facial recognition," 2018, vol. 37, pp. 16–19.
- [17] A. Wójtowicz, J. Chmielewski, S. Hammoudi, M. Smialek, O. Camp, and J. Filipe, "Face-based Passive Customer Identification Combined with Multimodal Context-aware Payment Authorization: Evaluation at Point of Sale.," 2018, pp. 555–566.
- [18] R. Greaves, "What is Apple Pay and How Does it Work?," *Ecommerce Platforms*, May 21, 2021. <https://ecommerce-platforms.com/articles/what-is-apple-pay-and-how-does-it-work> (accessed May 11, 2022).
- [19] R. goodwin, "Apple Pay Explained: A Complete Beginner's Guide....," *Know Your Mobile*, Oct. 06, 2020. <https://www.knowyourmobile.com/user-guides/apple-pay-explained-what-it-does-how-it-works/> (accessed May 11, 2022).
- [20] R. Greaves, "What is Google Pay and How Does It Work? (May 2022)," *Ecommerce Platforms*, Nov. 12, 2020. <https://ecommerce-platforms.com/payments/what-is-google-pay> (accessed May 11, 2022).
- [21] M. Anggo and L. Arapu, "Face recognition using fisherface method," 2018, vol. 1028, no. 1, p. 012119.
- [22] ArganoUV, "Face Pay: Is the Future of Payment with Facial Recognition?," *ArganoUV (United Virtualities) | Art + Software = Tech Consultants & Experts In Digital Experiences & eCommerce Development*, Feb. 22, 2021. <https://weareuv.com/face-pay-is-the-future-of-payment-with-facial-recognition/> (accessed May 11, 2022).
- [23] S. Singh, S. Bangalore, S. Amutha, and A. Girish, "Face Recognition for Payment and Information Sharing [J]," *International Journal on Recent and Innovation Trends in Computing and Communication*, vol. 8, no. 4, pp. 06–08, 2020.
- [24] S. Dangol and S. Kautish, "IT SECURITY RELATED ISSUES AND CHALLENGES IN ELECTRONIC PAYMENT SYSTEM IN NEPAL: A STUDY FROM CUSTOMER'S PERSPECTIVE," *Research Journal of Science, Technology and Management*, vol. 1, no. 2, pp. 85–103, 2019.
- [25] W. K. Zhang and M. J. Kang, "Factors affecting the use of facial-recognition payment: An example of Chinese consumers," *Ieee Access*, vol. 7, pp. 154360–154374, 2019.
- [26] V. N. Dornadula and S. Geetha, "Credit card fraud detection using machine learning algorithms," *Procedia computer science*, vol. 165, pp. 631–641, 2019.
- [27] A. Vinay, A. S. Cholin, A. D. Bhat, K. B. Murthy, and S. Natarajan, "An efficient ORB based face recognition framework for human-robot interaction," *Procedia computer science*, vol. 133, pp. 913–923, 2018.
- [28] J. A. Martins, R. L. Lam, J. M. F. Rodrigues, and J. M. H. du Buf, "Expression-invariant face recognition using a biological disparity energy model," *Neurocomputing*, vol. 297, pp. 82–93, Jul. 2018, doi: [10.1016/j.neucom.2018.02.054](https://doi.org/10.1016/j.neucom.2018.02.054).
- [29] S. Sawang, Y. Sun, and S. A. Salim, "It's not only what I think but what they think! The moderating effect of social norms," *Computers & Education*, vol. 76, pp. 182–189, 2014.
- [30] F. Liu, "Case Study of Facial-Recognition Payment in China," *Nielsen Norman Group*, Oct. 05, 2020. <https://www.nngroup.com/articles/face-recognition-pay/> (accessed May 07, 2022).
- [31] K. Hamann and R. Smith, "Facial recognition technology," *CRIM. JUST*, p. 9, 2019.
- [32] Hayes Adam, "How Point of Sale (POS) Works," *Investopedia*, Oct. 26, 2020. <https://www.investopedia.com/terms/p/point-of-sale.asp> (accessed May 10, 2022).
- [33] K. Okokpuije *et al.*, "Fingerprint biometric authentication based point of sale terminal," 2018, pp. 229–237.
- [34] H. Alzamel, M. Alshabanah, and M. Alsmadi, "Point of Sale (POS) Network with Embedded Fingerprint Biometric Authentication," *Hussah Adnan Alzame, Muneerah Alshabanah, Mutasem K. Alsmadi, "Point of Sale (POS) Network with Embedded Fingerprint Biometric Authentication", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN*, 2019.
- [35] S. C. Alliance, "Contactless payment and the retail point of sale: applications, technologies and transaction models," *Smart Card Alliance. Princeton Junction, NJ*, 2003.
- [36] Jessica, "Point of Sales System (POS) in Malaysia," *biztechup.com*, Aug. 14, 2021. <https://biztechup.com/pos-system-malaysia/> (accessed May 11, 2022).
- [37] R. J. Rodriguez, "Evolution and characterization of point-of-sale RAM scraping malware," *Journal of Computer Virology and Hacking Techniques*, vol. 13, no. 3, pp. 179–192, 2017.
- [38] Google, "Set up a screen lock for Google Pay - Android - Google Pay Help," Jan. 01, 2022. <https://support.google.com/googlepays/answer/10189798?hl=en&co=GENIE.Platform%3DAndroid> (accessed May 11, 2022).