

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Information Technology



Diploma Thesis

**Payment gateway for a small e-shop in the
Czech Republic**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bc. Viet Trung Nguyen

Systems Engineering and Informatics
Informatics

Thesis title

Payment gateway for a small e-shop in the Czech Republic

Objectives of thesis

The goal of this thesis is to evaluate options of a small e-shop construction module in the legal condition of the Czech Republic. The thesis will be focused on solving problems with the Czech e-registration of internet payments and will look for Czech-specific legal alternatives such as SMS-payments, card-gateway, PayPal or similar. The result in the form of a pluggable module will be tested in some real environment.

Methodology

There will be used standards of the software engineering, first of all UML and WebML. The first part of thesis will include a literacy review and a survey of possible technologies. The second and practical part of thesis will be a small real example of selected solution. The application will use standard features of internet providers, which include web-domain, PHP, MySQL, FTP-access operating on a Linux-based virtual server.

The proposed extent of the thesis

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e-shop, payment gateway, CMS, Wordpress, Joomla, Drupal

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Agashe, A. (2019) Blockchain Bubble or Revolution: The Present and Future of Blockchain and Cryptocurrencies

Blokdyk, G. (2019) E-Payment Gateway A Complete Guide

Mabry, R. (2012) E-Commerce Blueprint: The Step-by-Step Guide to Online Store Success

Sidelov, P. (2018) The World Of Digital Payments: Practical Course

Ullman, L. (2011) PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide (4th Edition)

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Declaration

I declare that I have worked on my diploma thesis titled "Payment gateway for a small e-shop in the Czech Republic" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on

_____06/04/2020_____

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Payment gateway for a small e-shop in the Czech Republic

Abstract

Currently, with the explosive growth of electronic commerce (e-commerce) and the dramatical increase in popularity of online transactions, the pressure of attracting more and more customers to commercial websites is an issue to most businesses. They are fully aware of the great volume of daily transactions on e-commerce sites, and for that, being able to offer top-notch, convenient and swift payment methods to customers could be “a matter of life and death” to businesses. Medium and large businesses could have the resources to invest and provide customers with a variety of payment methods. However, choosing and enriching payment methods could be difficult for small businesses on the aspects of system management and finance. Capturing the situation, this thesis with the topic "Payment gateway for a small e-shop in the Czech Republic" has been selected. The thesis aims to offer solutions to improve the quality of services, and simultaneously, to develop and increase the competitiveness in digital payments of small businesses.

Keywords: e-shop, payment gateway, paypal, Wordpress, stripe, bitcoin, Czech Republic

Platební brána pro malý E-shop v České republice

Abstrakt

V současné době, s prudkým růstem elektronického obchodu (e- commerce) a s dramatickým nárůstem popularity online transakcí, se strategie k přilákání více a více zákazníků na komerční webové stránky dostává pod tlak a tímto vzniká problém pro většinu podniků. Jsou si plně vědomi toho, že velký objem denních transakcí se probíhá na stránkách elektronického obchodu, a proto schopnost zákazníkům nabídnout špičkové, pohodlné a rychlé platební metody by mohla být pro podniky „otázkou života a smrti“. Střední a velké podniky by mohly mít zdroje k investici a poskytování různých platebních metod zákazníkům. Nicméně, výběr a zlepšení platebních metod by mohly být těžké pro malé podniky ohledně správy a financování systému. Pro zachycení této situace byla zvolena práce s tématem „Platební brána pro malý e-shop v České republice“. Tato práce si klade za cíl nabídnout nejen řešení pro zlepšení kvality služeb, ale i současně pro rozvíjení a zvýšení konkurenceschopnost digitálních plateb malých podniků.

Klíčová slova: e-shop, payment gateway, paypal, Wordpress, stripe, bitcoin, Czech Republic

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List of abbreviations

E-Commerce : Electronic commerce

ROI : Return on Investment

CR : Czech Republic

EFT : Electronic Fund Transfer

EDI : Electronic Data Interchange

UK : United Kingdom

E-Cash : Electronic cash

EMV : Europay, Mastercard, and Visa

ATM : Automated teller machine

SMS : Short Message Service

E-wallet : Electronic wallet

API : Application programming interface

QR : Quick Response

NFC : Near-Field Communications

URL : Uniform Resource Locator

COD : Cash On Delivery

PHP : Hypertext Pre-processor

HTML : Hypertext Markup Language

RDBMS : Relational Database Management System

SQL : Structured query language

OSS : Open Source Software

CMS : Content Management System

IBAN : International Bank Account Number

BIC : Bank Identifier Code

SWIFT : Society for Worldwide Interbank Financial Telecommunication

Introduction

During the last thirty years, the blossoming of Internet and Information Technologies has built up a strong base for the development of e-Commerce, or electronic commercial activities. Thanks to the growth of the Internet and World Wide Web, not only are the Communication and Service expanded in size and scale, but also did the e-Commerce's complexity and advancement. The traditional over-the-counter commerce with physical cash and cheques have gradually brought to consumers the convenience to transact anytime, anywhere. This cashless commercial revolution has changed and gained grand benefits to society through the cost deduction and time saving to both consumers and businesses. Undoubtedly, digital financial payment is the key element to the effectiveness of e-Commerce, since it is an irreplaceable part of any online transactions, and in most cases, also acts as a proof or contract of transaction between sellers and buyers on the Internet. Thus, the more inclusive the digital payment is, the more comprehensive the Commerce could become and evolve. The scope of this thesis is to cover the **some of the popular digital payment methods** in Czech Republic, and which related points a business in CR should identify when they apply these methods to their online products.

Objectives and Methodology

1.1 Objectives

The main goal of this thesis is to propose recognitions and comparisons between some of the most popular online payment methods in Czech Republic. Moreover, companies providing products online could refer to this research to expand the choices of their consumers looking a suitable payment method, and at the same time reinforce more buy power. The said comparisons are studied and evaluated through the e-Commerce website <https://tamdaexpress.eu/> based in Czech Republic.

The below research questions are chosen in order to break down and clarify the objectives of this research, as it is understood that the more consistent these research questions are to the objectives, the more precise and practical the final conclusion would develop into.

- What are the current trends of online payments?
- What are the strengths and weaknesses of the existing online payment methods?
- What are the ROI of online payment?

1.2 Methodology

The methodology of the thesis is based on the latest industry and scholar resources. Upon the two main parts of the thesis, the Theoretical part of the thesis will introduce and describe the latest summary of analysis and assessments on the on-going payment methods, including the detailed operation processes. On the other hand, the Practical section will include statements about the situation and organizational requirements on the current payment methods. The suggested solutions regarding to these methods will be compared and evaluated on the real system. The results of the practical part will be based on to formulate the final conclusions and recommendations.

Literature Review

1.3 E-commerce

1.3.1 E-commerce concept

Developed in the 70s of the last century, the forerunner of e-Commerce was EFT , which was shared and put in use among organizations. The following platform was EDI transferring documents and data between large enterprises. The Internet came in 1969 , which was initially used only by the US Government. It later was put in use in universities and research institutes, and then got commercialized and led to the introduction of the World Wide Web in the early 1990's. The concept e-Commerce was then presented accordingly.

In CR, the Internet was firstly introduced in 1992 and has become more commonly used since 2003. The concept of e-Commerce is still unfamiliar to many people in the year 2003 – 2006. Since 2006, e-Commerce has become more popular, and by 2014, it became a hit with 39% of Czechs choosing online shopping instead of traditional shopping.

1.3.2 E-commerce status

As of 2018, e-Commerce market in Europe was valued at €547 billion and by 2019, it reached €621 billion, topped by the UK, France and Germany. Most of the total online sales income was from Western Europe, which accounted for 66% of total retail online sale income. Southern Europe, Northern Europe, Central Europe and Eastern Europe showed much lower rates with 14%, 9%, 6% and 4% respectively.

Annual European B2C Ecommerce Turnover 2013-2019(Euro, Billion)

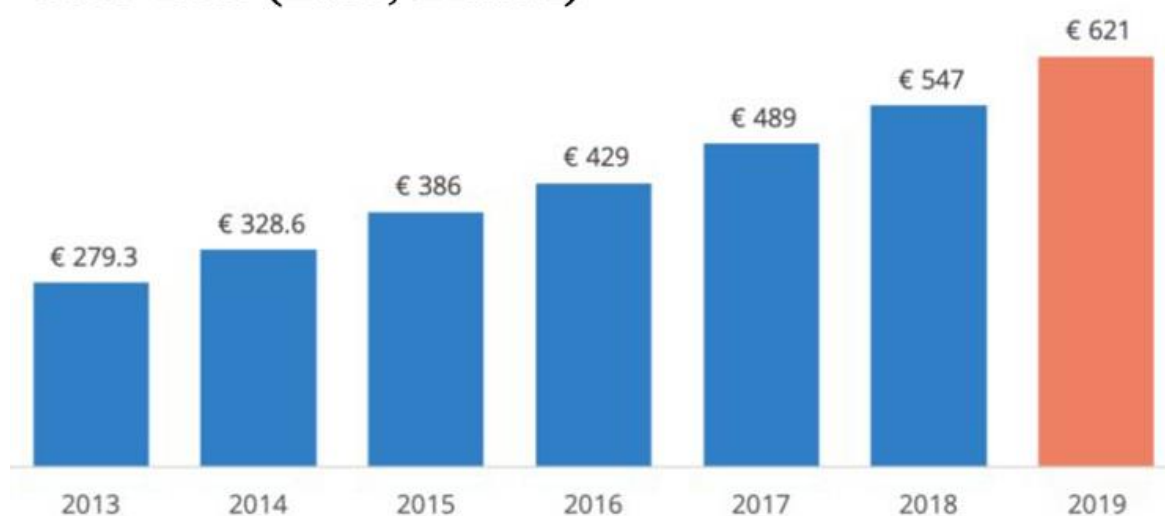


Figure 1 Ecommerce turnover in Europe, from 2013 to 2019

The annual growth rate of e-Commerce in European countries still increases sharply, but it is still slower in speed than those of bigger markets. Apart from this, the Czech Republic, with quite modest market size of only €5.25 billion value in 2018, accounting for 0.8% of the total European e-Commerce market, has stood out to be European fastest growing e-Commerce with growth rate of 16%. This figure is strengthened by a large-and-growing number of Czech online stores: in 2017 specifically, online digital devices stores in CR has increased by 3.900, reached up to 40.100 in numbers.

	Country	Currency	E-commerce compound annual growth rate (2017-2021)
1	Czech Republic	CZK	16%
2	Italy	EUR	14%
3	Spain	EUR	13.5%
4	Norway	NOK	13%
5	Portugal	EUR	12%
6	The Netherlands	EUR	11%
7	Finland	EUR	11%
8	France	EUR	10.5%
9	Denmark	DKK	10.5%
10	Poland	PLN	10%

Table 1: Compound annual growth rate of ecommerce in Europe

The figures reflected in the field of e-Commerce in Czech has proved that CR is a very potential market for e-Commerce.

1.4 Online payment

1.4.1 History of online payment

The first financial institution offering online banking services to its members was the Stanford Federal Credit Union in 1994, whose pioneer establishment was following the internet development in the first half of the 90s. Unfortunately, these first online payment system were not user-friendly and also had some specialized knowledge requirements of encryption or data transfer protocol. Moreover, the systems were not able to fully adapt constant changes in users' numbers and their transactions.

Millicent (founded in 1995), ECash or CyberCoin (founded in 1996) were the core players of the e-payment market. These very first online services tended to use micro payment systems, whose attribution was the ambition to initiate the electronic cash alternatives (e-money, digital cash or token)

1.4.2 Definition of online payment

Over the past 2 decades, online payment systems have attracted a lot of attention from researchers and information system designers due to its important role in modern e-Commerce. This leads to a number of studies and different perspectives on the definition of electronic payments. These concepts are mainly viewed from different angles, from scholars in the field of accounting and finance, business technology and information systems.

- Dennis (2004) defined an electronic payment system as a form of financial commitment involving buyers and sellers through the use of electronic communications
- Briggs and Brooks (2011) believed that electronic payment is a form of association between organizations and individuals supported by banks that allow the exchange of cryptocurrencies.
- According to Adeoti and Osotimehin (2012), electronic payment system refers to an electronic means of payments making for goods and services online at supermarkets and shopping centers.

- Electronic payment is a way of paying with electronic money for goods or services when shopping, instead of using cash or checks in person or by mail. Electronic payment systems are usually classified into four categories: credit cards, debit cards, electronic money and micropayment systems (Maiyo, 2013).
- Another definition was introduced that electronic payments are payments in e-Commerce environment, while the exchange of money is through electronic means (Kaur and Pathak, 2015).

In summary, according to the above definitions, an electronic payment system could be simply seen as a collection of components and processes that allow two or more parties to engage in transactions and the value of money exchanged through electronic channels.

1.4.3 Characteristics of online payment systems

The infrastructure that is necessary to facilitate payment on the Internet will be brought by electronic payment systems. The electronic payment systems have been an vital part of the development of e-commerce and electronic businesses in general, and for this, electronic payments must have strong characteristics to be accepted worldwide. Atomicity is trusted to make sure that there is no loss of existing money during the transaction, and therefore the new transaction can be made.

- Confidentiality/Information kept secure: The record of transaction kept in the organization as safe as can be and it should only be available to the confidential level if there is any need for traceback at some stage.
- Security: The system must ensure the possibility of fraud within the system.
- Availability: The system must be available during the said working hours.
- Cost effective: The transaction cost must obey the rules as per authority.
- The ability of integration: The system must ensure that it can work with all other existing payment systems that resemble the properties and they must be integrated with the new payment system within the same environment .

(Blokdyk, E-Payment Gateway A Complete Guide, 2019)

1.4.4 Benefits of online payment

- For the Government

Non-cash payments play an important role in shortening the amount of cash in circulation, therefore reducing the enormous social costs associated with issuing and circulating money. The traditional method of cash payment today will cost a lot in money printing, tallying, securely delivering cash from banks to banks, including the considerable time spent on cash checking, preserving, exchanging old and torn bills; not to mention limiting the threat of counterfeit money... With the non-cash payment method, these mentioned waste and costs could be kept to the minimum.

- For Businesses and Consumers

Accelerating money and goods circulation

E-Commerce payment has the advantage of accelerating the circulation of money and goods. Sellers can receive payments via online channels almost instantly, the goods delivery therefore could be performed early, so the capital could be reclaimed soon to invest in production.

Ensuring economical and convenient advantages

Using electronic payment methods will bring great benefits to both businesses and consumers in decreasing processing costs, and simultaneously encouraging customers and consumers to access global markets.

Providing swift and safe services

E-payment helps to make payments quickly and securely, keeping benefits guaranteed for the parties involved in payment, limiting risks compared to cash payment.

1.4.5 Online payment status and trends

In 2019, there were 5.2 million e-commerce users in the Czech Republic, and it is expected that by 2022 there will be 5.4 million users, according to Research and Markets, in 2017, there were 90% of users. Czech consumers have been shopping online at least once. Cash is still the preferred payment instrument in the Czech Republic, accounting for 62.1% of total payment transactions in 2018.

However, cash payments are expected to decline by 2021, which is predicted to be underpinned by rising card payments in 2019. About 1.1 billion card payments were registered in the Czech Republic in 2019 - a significant increase compared to 483.7 million card payments made in 2014. It is forecast that by 2020 there will be 1.7 billion payments.

Total card payments by volume in the Czech Republic 2014-2020f (millions)

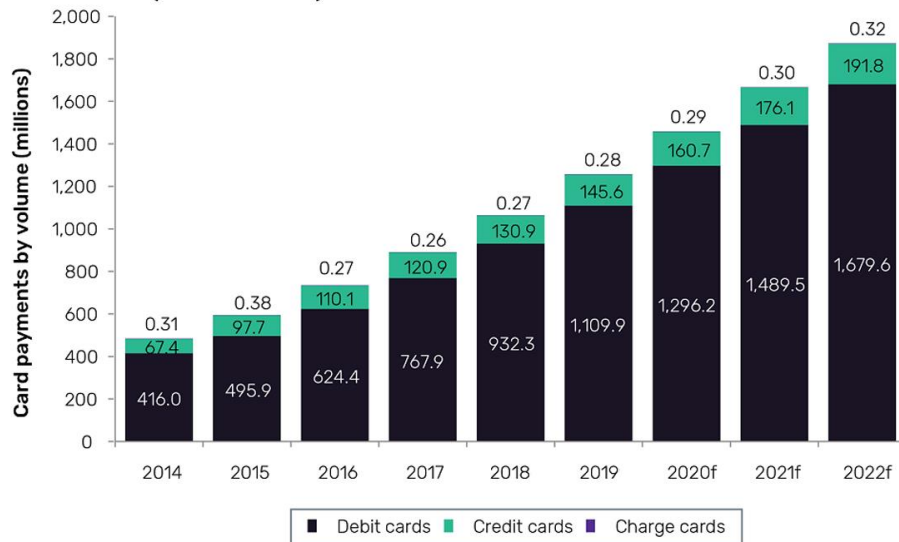


Figure 2 Czech Republic card payment trends

Digital wallets has also developed and currently accounted for 7% of the payment methods. However, with an annual compound growth rate of 35%, digital wallets will only consume 11% of market share by 2021.

The abovementioned growth rates have been supported by smartphone penetration, which has gained up to 67.3% (2019). Besides, the related arrival of mobile banking and payment applications is also improving the e-payment of users in the Czech Republic.

E-commerce payment method splip by value

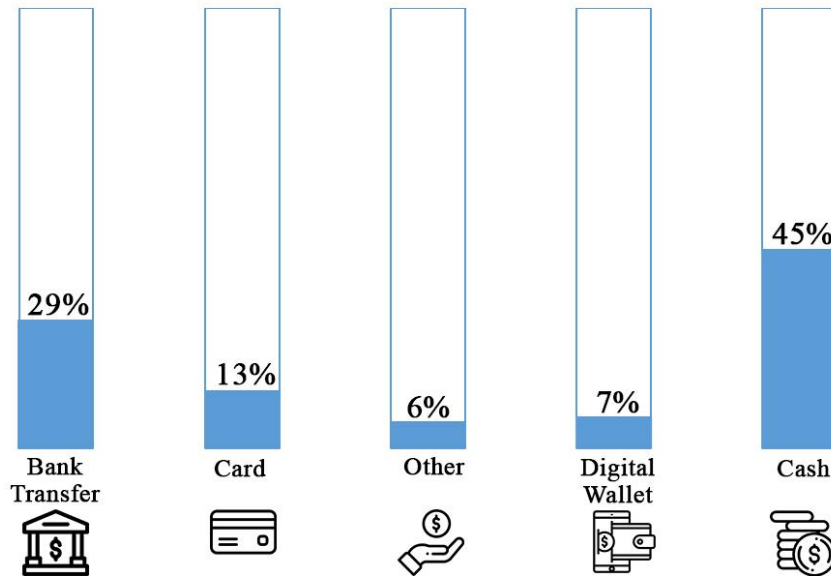


Figure 3 E-commerce payment method splip by value

1.5 Online payment methods

It is essential for any online stores owners to find out which types of payment methods to use. Not only because there are many different types of payment methods to choose from, but each specific type is optimized to work best for the business, or in other words, to maximize revenue opportunities.

There are 5 basic categories of payment methods in the Czech Republic:

- Card Payment
- Bank Transfer
- Mobile Payment
- E-Wallet
- Bitcoin

1.5.1 Card payments

- **Introduction**

Bank card is a very popular global payment solution, which is one of the instruments that helps customers to pay for online transactions. Bank card consumes 65% of the total online payment transaction methods in the Czech Republic, and mandatorily requires customers to have a card registered with a bank.

A bank card or payment card is a card registered with the bank, which could be used to pay for goods and services at some places that accept the card when making purchase instead of cash. It could also be used to withdraw cash directly from Banks or Automated Teller Machines. Nowadays, payment cards can be issued by banks, financial institutions and a few issuers in the form of gift cards and service cards.

Payment card is currently classified by function, which are Debit Card and Credit Card.

- **History of credit cards**

In 1950 the Diners Club Card was invented as the first multipurpose charge card by Frank McNamara, an American businessman. The Diners Club Card is the foundation of what we know as the credit card today. In 1958, American Express Company has launched its first charge card, revolutionized the new century of cashless payments. This first charge card was the BankAmericard, which came with the \$300 limit and was also the first credit card to offer revolving credit. In 1970, BankAmericard was spun off into National BankAmericard Inc., and in 1976, this organization became Visa. In addition, after being rebranded as Master Charge in 1968, Mastercard was formed in 1979.

The EMV chips or magnetic strips are not always on payment cards. Before magnetic strips, the imprints on payment card are taken by machine to capture and process the payment information. The processing center will receive the copy of the card information, which will eventually be transported in a computing system. Later, in 1969, IBM developed a standard for magnetic strips, which allowed payment card to use magnetic strips to transmit card information worldwide.

Until recently, when magnetic strips have not been the most common ways to store and transmit card information, came a new technology, the EMV chip. The EMV chip aimed to make card transactions more secure by generating unique, one-time code to approve transactions.

- **Debit Card**

Debit cards are electronic payment cards based on the form of prepayment that perform transactions in accordance with the amount of money in the account. Each debit card is tied to an account, and customers can only use the card to pay if their account has sufficient amount of fund, which is the reason debit cards are often called payment cards. However, in

addition to the payment function, debit card can also be utilized as an ATM card for common activities like money withdrawing, balance checking, money transferring, statement printing...

- **Credit card**

Credit card is a type of card that allows the cardholder to borrow money (debt) from the bank with an approved credit limit to purchase goods and services. As long as the credit card holder pays (for the debt) within the specified time period (usually 45 days), there will be no additional charges. If the cardholder exceeds the time limit, the bank will calculate the interest based on the amount of debt the credit cardholders have "temporarily borrowed" from the bank.

- **Mode of operation**

Card issuer (Issuing bank) - A financial institution (e.g. the bank) that issues credit or debit cards to its clients.

Card association (Card network) - Financial operations that process the payments of card based on an agreed set of rules, commonly known as Visa and Mastercard.

Card acquirer (Acquiring bank or merchant bank) - A financial institution that processes transactions based on information from the Card issuer and Card association. The business concept is to provide card acceptance to merchant accounts, which are licensed members of Card associations.

Payment software - Software that transfer customer's card details from a website of a merchant to a payment processor.

- **Sequence Diagram**

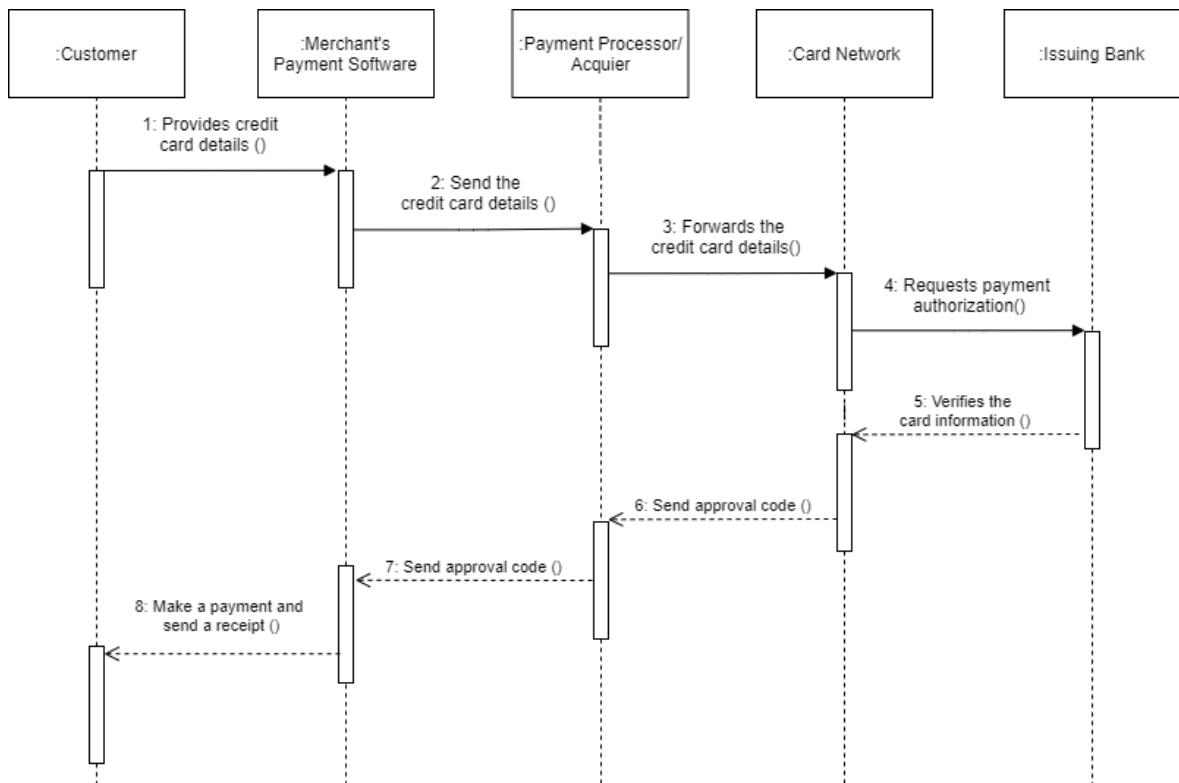


Figure 4: Card payments sequence diagram

1. Customers checkout at merchant’s website and decide to pay with either their debit or credit card by submitting their card details
2. The payment software of the merchant transmits the payment transaction information to the payment processor from the merchant’s acquiring bank
3. The transaction information will then be securely forwarded to the card association
4. The transaction information is securely transferred by the card association to the customer’s issuing Bank, which then be checked if customer’s fund is sufficient for the transaction, and the transaction is not fraudulent
5. The card association then receives a response submission from the customer’s Issuing Bank, indicating whether the transaction is approved or declined
6. Merchant’s payment processor will be relayed with the response from the card association
7. The payment software will be relayed with the response from the payment processor
8. The payment of customer will then be made and the payment receipt will be sent to customer

- **Card payments security**

Apart from basic security steps, in order to ensure safety for businesses and customers' online payments against potential card payment frauds, application of 3D secure could be considered as a solid solution.

3D secure V1.0

3D Secure is a security protocol created to offer an additional layer of protection for online transactions made by debit and credit cards. It was designed by Arcot Systems in 2001, and was first used by Visa with the purpose of providing advanced security for Internet payments. The concept is that when a customer is making online payment for something, he/she is redirected to their 3D secure page on their debit/credit card provider's website. On this website, customer will be asked for a password (which should have been set up with the bank beforehand), or to enter an authentication code (which is automatically sent to their phone number). After being provided with the correct details, the card provider will approve the payment and direct it back to the website. This process will be done very swiftly. Once the customer is back to the website, they will receive confirmation that their payment has been successfully made.

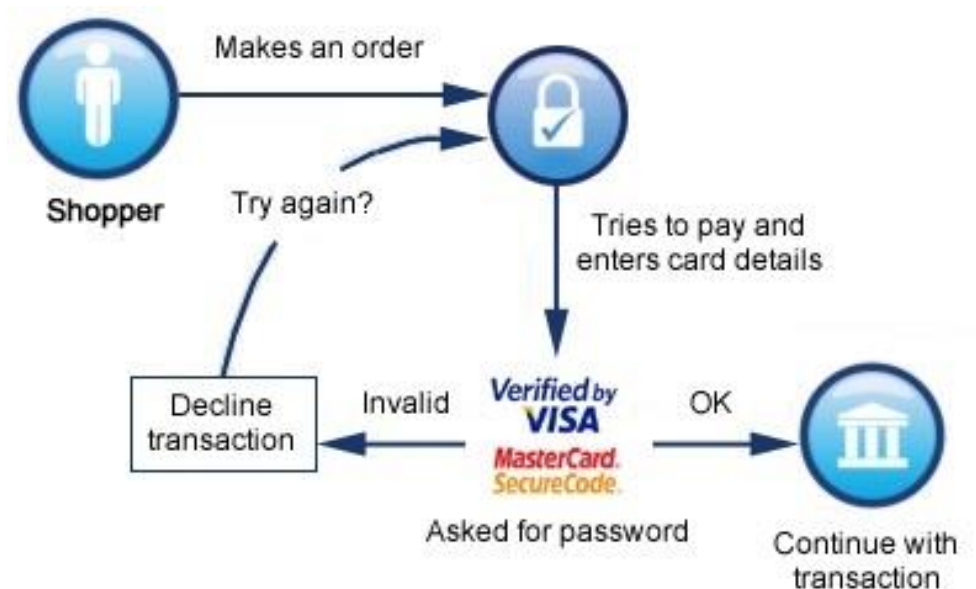


Figure 5 3D Secure V2.0

3D Secure V2.0

In October 2017, a new version of 3D Secure, the protocol that authenticates ecommerce transactions, has been published. It contains many improvements to make it simpler to achieve strong customer authentication (SCA) on e-Commerce transactions. The main improvements are:

- Active payment pages that is accessible to any devices;
- Reinforcement of biometric authentication (fingerprint / face id);
- Enhancement of uninterrupted authentication flow

During a 3D Secure authentication, the quality of the authentication performance depends on the card issuer. There are no arguments that the SCA is achievable with 3DSv1, but 3DSv2 is an upgrade that helps obtaining SCA much easier.

1.5.2 Bank transfers

- **Introduction**

Bank transfers are simply the direct transfer of funds from a customer's bank account into another individual's or a business' bank account. Unlike other payment methods covered in this guide, bank transfers do not have any specific setup requirements on the business' behalf to begin accepting payments from customers. In general, the process is quite simple, but may differ from country to country, and particularly so when the business' bank and customer's bank are located in different countries.

- **Sequence Diagram**

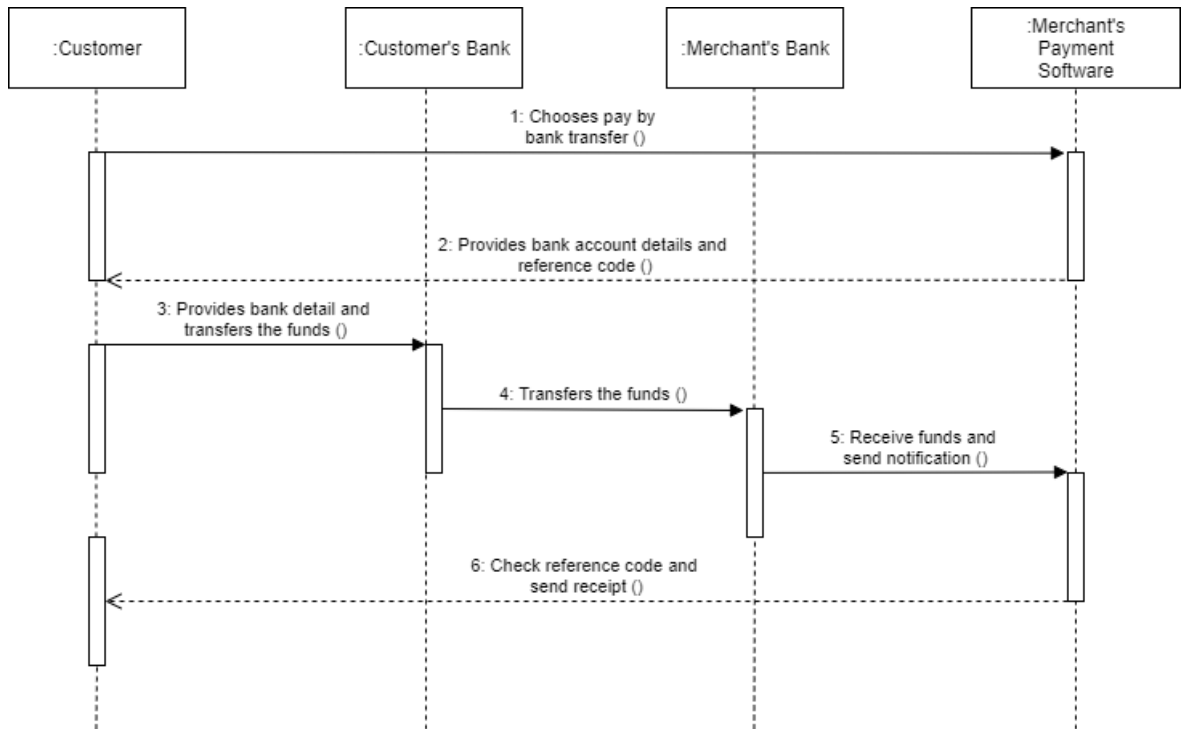


Figure 6 Bank transfers sequence diagram

1. Customer selects to pay for the transaction via bank transfer after completing his/her checkout at the merchant.
2. The bank account information is provided to the customer by the merchant, normally along with a one-time transaction reference code.
3. The bank then will be instructed by the customer to transfer the relevant fund to the merchant’s bank account.
4. Bank of the customer transfer the funds to bank of the merchant.
5. A notification is sent to the account from the merchant’s bank, remarking the reference code.
6. The reference code is checked by the merchant and a receipt is sent to the customer.

- **Bank transfers security**

The safety of bank transfer payment depends mostly on the human factors and the banks’ security system. Nevertheless, the risk of bank transfer has been kept to the minimum thanks to the advancement of security and authentication systems of the bank.

1.5.3 SMS payments

- **Introduction**

Goods and services could be paid for via text messages sent from a mobile phone, also known as SMS payment. This type of payment technically works like standard SMS: the text message is sent by the customer to mobile payment service providers to pay for an item or a service. The service provider clears the transaction between the customers and the merchant. The monthly phone bill will also be included with the cost of the purchase; or if customer uses prepaid balance, this cost will be deducted from this balance by the telecommunication service provider. The SMS payment supports customers to make the payment for goods and services securely, promptly and safely.

- **Sequence Diagram**

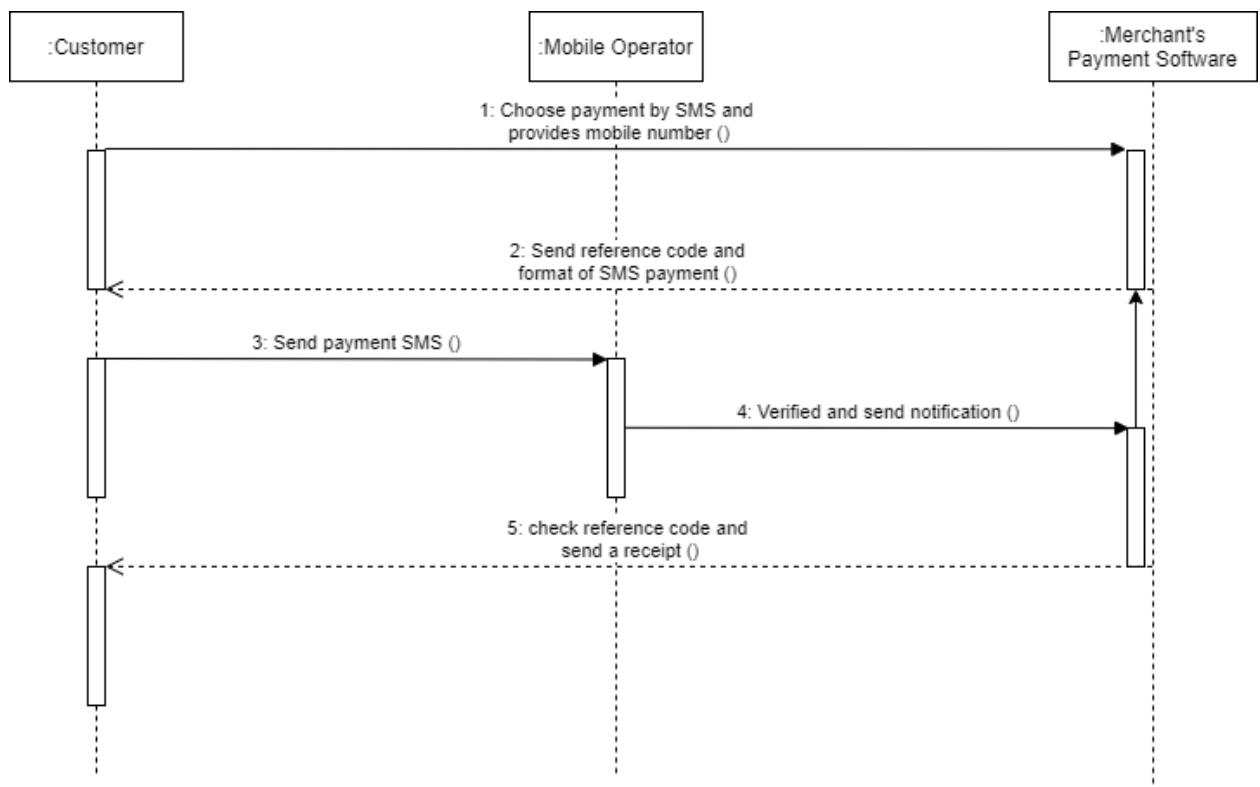


Figure 7: SMS payments sequence diagram

1. Customers select SMS payment option and provide their phone number to the merchant
2. The merchant receives new payment request, and sends to customer a reference code together with the specific format of the SMS

3. Customers receives the SMS and send the correct format of the payment SMS along with a reference code to the telecommunication service provider
4. The telecommunication service provider checks information and informs the merchant
5. The merchant checks reference code and send a receipt to the customer.

- **Merchant receives customer's money**

The customer selects SMS payment, which includes the cost of the purchased item or service. The cost of these will be deducted customer's monthly phone bill or from the pre-paid balance. When the phone bill is paid, the telecommunication service provider takes their share from the SMS price. The telecommunication service provider then sends the remain of the payment to the SMS payment processor company operating the SMS gateway, to which is the name of the number the Customer sends the payment SMS to buy items or services. Subsequently, this SMS payment processor takes their share from the whole payment and eventually passes the rest to the company supplied the products or services. From the beginning to the end, Customer's details are only revealed to the telecommunication service provider, clarifying why SMS payment is said to be secure and safe.

- **SMS payments security**

Sharing similarities with transfer payment, the SMS payment method's safety majorly depends on the security of the telecommunication service provider and the device that the customer uses to perform payment. Additionally, customer does not need to enter their credit card details or bank details to make payment, therefore mitigating the risk of their credit cards or bank accounts being hacked into.

1.5.4 E-wallet payments

- **Introduction**

Paying with e-wallet is another form of making transaction, where customers can easily complete without the need of a physical payment card. As of the good and convenient customer experience, companies like PayPal have relatively standardized the digital wallets experience globally.

- **Digital wallets**

An e-wallet (or digital wallet) is a software-based system created to perform e-Commerce payments. Online goods and services could be easily paid with e-wallet right from customers' computers, tablets or smartphones. Generally, customer's bank accounts are linked to their e-wallets, and customers' credentials are safely stored and verified in the e-wallet system. E-wallets, apart from being used for online transactions, are also used as an authentication method of customers, because an e-wallet is capable of storing customer information, including personal information, credentials and transaction history. E-wallets can also be combined with other mobile payment systems.

There are 2 main components of a digital wallet: the software application and the information storage. The software application takes responsibilities for the encryption, the security and the transaction, which as well provides customer interface and secure transaction capabilities. It is compatible with most of the online shopping sites. The info storage is in fact a database of information input from customers, which includes billing, shipping address, and payment methods. Additionally, there is one more type of digital wallet, the server-side digital wallet, which is created by the organization for users, and said to be more secure, effective and have extra functionalities.

- **Client-side wallets**

Client-side wallets generally specifies the digital wallets that controlled by customers directly. After customer downloading and installing a digital wallet program/application into their personal computer/device, they shall enter their relevant payment and shipping information. When the customer finishes their shopping and decides to check out, their wallet's software will fill in most of the basic information of customers onto the compatible shopping site. The whole process will make the shopping experiment of the customers quicker and more private.

- **Server-side wallets**

Instead of placing their data in a personal hard drive, customer uses e-wallet as a secure server for their e-wallet database. Their purchases on e-Commerce sites therefore would be extremely fast, as customer's debit or credit accounts could be recognized easily by the

website without any bothers of info entering. This helps customers to avoid any risks of security associated with the card information.

- **Paying using stored payment details**

This form of payment is applied when customer wants to perform a transaction using their e-wallet because of the e-wallet's payment detail storing feature. The process will be likely identical to a standard card payment method, since the details of customer's debit or credit card is stored in the e-wallet. The sole difference is that the provider of the e-wallet may be showing the facilities of a payment service provider to the merchant. The e-wallet in this scenario works like a digital brain storing relevant information input.

- **Paying with stored funds**

Before making payments, customer needs to perform funds transfer into their e-wallet via a variety of different payment methods, such as bank debit or credit card, bank transfer, or from other e-wallets. Once customers make a payment using the mentioned stored funds, the merchant shall receive the fund with their own e-wallet from the same provider. The same standard bank transfer shall be applied if the merchant wishes to transfer the fund from the e-wallet into their bank account.

- **Sequence Diagram**

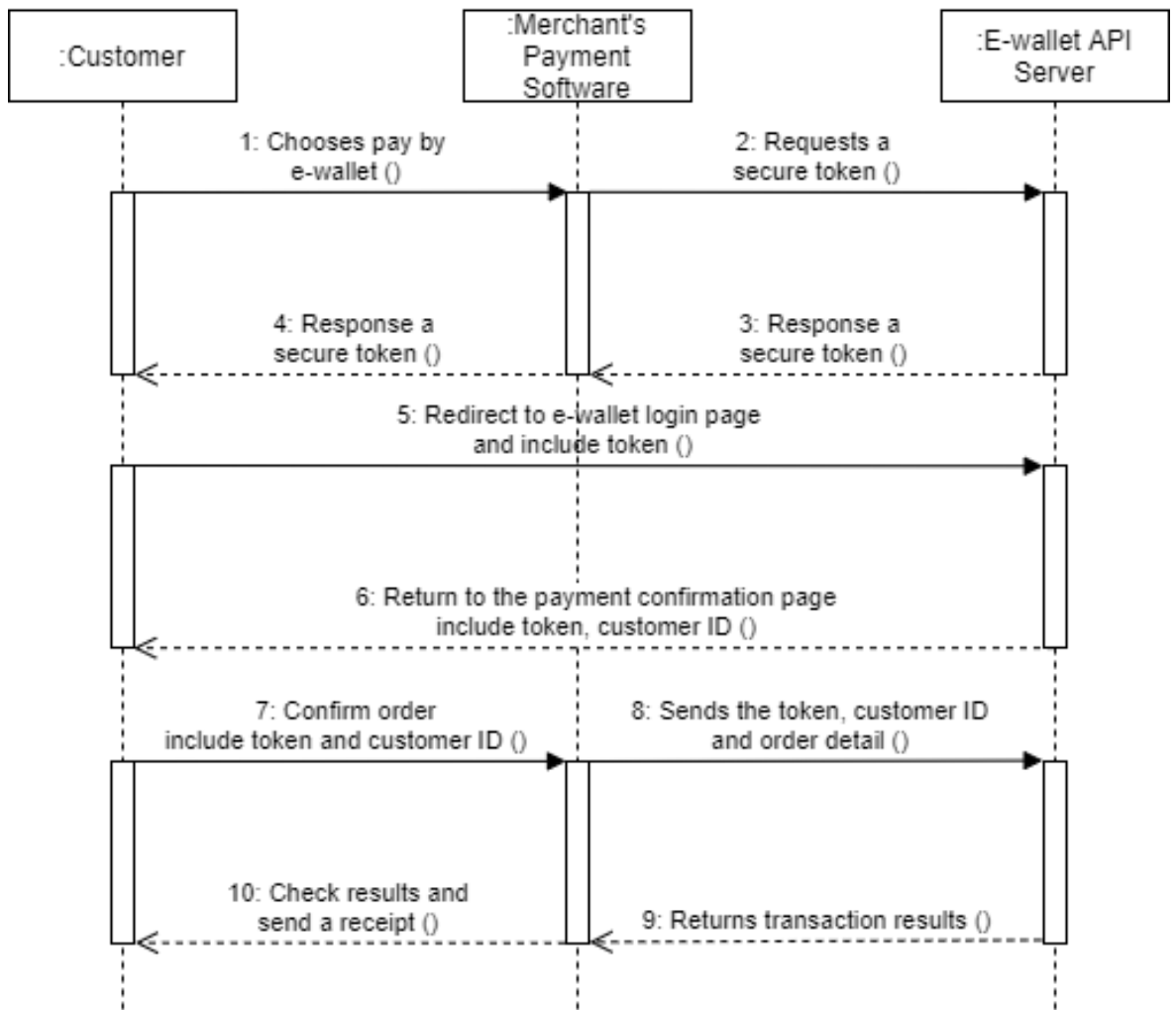


Figure 8: E-wallet payments sequence diagram

1. Customer completes the order and prefers to pay with e-wallet
2. The payment software of the merchant will request a secure token from e-wallet API server, then the cart info will be sent to e-wallet API server
3. A token and payment information will be sent from the e-wallet API server, and string value is used to track customer during the checkout
4. Customer then receives a response from the merchant’s payment software
5. Customer is redirected to the e-wallet site for verification, where they can log in and select payment method
6. Customer gives out approval for the payment and be redirected back to the payment confirmation page

7. Order confirmation, including token, customer ID and final cart information will be input and sent by customer
8. The information then shall be forwarded to e-wallet API server by merchant's payment software
9. The payment is captured by the API server of the e-wallet, the fund subsequently is transferred to the proper merchant account from customer account
10. An order is created by the merchant's payment software and a receipt is sent to customer

- **E-wallet payments security**

Encryption Technology

The security of mobile wallet is enhanced with strong modern encryption technology of e-wallet payment providers. By turning normal data or "plain text" into a combination of random characters ("ciphertext"), the encryption will allow only those with a "special key" to read the data. The majority of companies secure their data often use a 128-bit data encryption technology.

Password Protected

E-wallets allow consumers to add an additional password protection to their e-wallet account. They include complex alphanumeric passwords as well as biometric protocols, such as fingerprint access and voice activation.

Acts as a Proxy

Customer's banking and confidential info can be help concealed with a secure e-wallet service. Basically, customer can make available only the fund they want the e-wallet to access, which means that the e-wallet does not have access to customer's wider banking information to make payment. Their metadata, as a result, shall not be logged and captured by a third party.

1.5.5 Bitcoin

- **Introduction**

Invented by Satoshi Nakamoto as an open source software since 2009, Bitcoin, or BTC, has been the first cryptocurrency in the world and laid the foundation for the development of the cryptocurrency market ever since.

Bitcoin uses a peer-to-peer protocol for all transactions that eliminates the intermediary steps in the process of performing payments. This means that transactions will be directly made between the customer and the merchant with extremely low transaction fees (almost zero), and without the requirements of any intermediaries or organizations.

- **Bitcoin wallet**

Bitcoin wallet is to contain bitcoin, implement sending and receiving Bitcoins, and give ownership of the balance of Bitcoin to the users. There are many forms of Bitcoin wallets, i.e. desktop, hardware, web and mobile.

Types of wallets

Paper

A paper wallet of Bitcoin is mainly a document containing an address for customers to receive Bitcoin and a private key, in which they are allowed to spend or transfer stored Bitcoin. Paper wallets are usually displayed in form of QR code, which makes the payment easily performed when customers scan and add the key to the software wallet.

Physical Bitcoin

Physical Bitcoin was initially shaped like a credit card in its first publish, but most of the followed alternatives were shaped like a round medal. A cryptocurrency enthusiast, Mike Cadwell, created the first popular physical BTC in 2011, the Casascius after his nick name. It had a peelable hologram concealing the private keys that when it is removed, it left a tamper-evident mark; and once the coin is redeemed, it lost its digital value. Physical BTC is a protected way of stashing customer's funds, and could be very convenient when trading offline.

Mobile

Besides physical Bitcoin, a BTC mobile wallet is also a helpful tool for BTC owners. Technically, it has the same function with physical BTC, but now customers can pay for things with BTC directly from their phone. Furthermore, some applications also make it possible for customers to use near-field communication (NFC) technology, so customers only need to tap their phones against the terminal to pay without providing any information.

Web

The customer data, including private key, will be saved in the hard drive of customer's computer, where the wallet is downloaded and installed. Together with this, the data is now more protected as it is independent from third parties for data storage and hard to steal.

Hardware

BTC hardware wallet is an exceptional type of e-wallet, which stashes the customer's private keys in a safe hardware device, and is said to be the most secure form of BTC storing as there have been no records of money stolen incidents from a hardware wallet. Besides the interactive feature, the advantages of hardware wallet are its immunity to computer viruses, and the funds are impossible to be transferred out of the device.

• Sequence Diagram

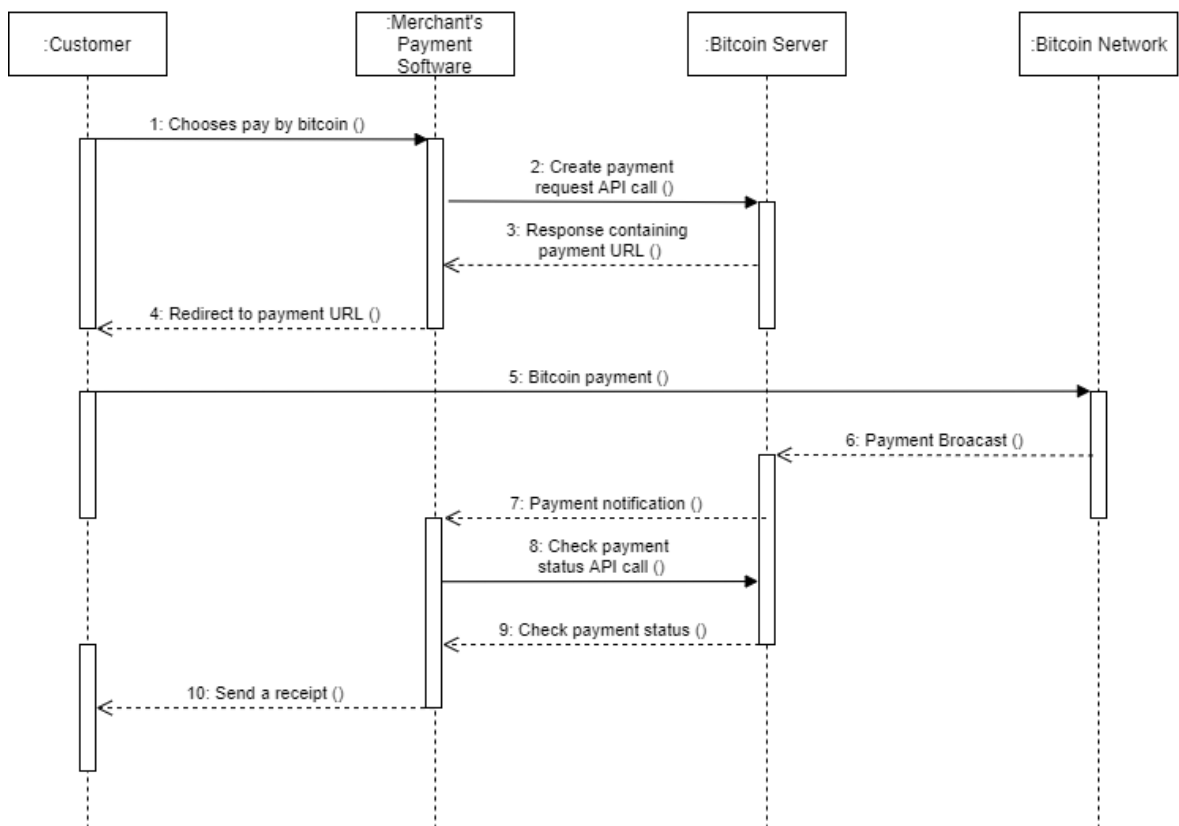


Figure 9 Bitcoin sequence diagram

1. Customer completes the order and prefers to pay with Bitcoin
2. The merchant's payment software requests API from Bitcoin server

3. The Bitcoin server will response to the merchant's software with a URL containing payment info
4. Customer then receives a response from the merchant's payment software to the checkout site
5. Depending on each different bitcoin wallet, customers can choose to pay from the address or the displayed QR code
6. The Bitcoin transaction is then broadcast to the network and collected into blocks
7. The Bitcoin server makes announcement to the merchant's software
8. The merchant's payment software checks the status of the payment
9. A complete payment confirmation is received by the software
10. A receipt is sent to customer from the payment software

- **Bitcoin security**

Blockchain

Blockchain is a decentralized database that stores information in information blocks linked together by coding and extending over time. Each information block contains information about initialization time and is linked to. The previous block included a time code and transaction data. Blockchain is designed to prevent data from being changed: Once the data has been accepted by the network, there is no way to change it.

Practical Part

1.6 Tamda Foods Ltd.

1.6.1 Description of the Company

Tamda Foods Ltd. is a Vietnamese company founded in 2008, whose initial business targets was importing and supplying wholesale foods and groceries across Vietnamese grocery stores in the Czech Republic, including the local businesses operating in the food business. After 3 years of construction and instalment, on March 29, 2011 Tamda Foods Ltd. officially opened its first wholesale warehouse in Sapa Trade Center, Prague 4, CR. Throughout 9 years of operating and developing, supported with trained, enthusiastic employees and strong, quality employers, Tamda Foods has gradually gained customers' trust and opened two more branches in Brno (July 2015) and Ústí Nad Labem (June 2019).

1.6.2 Current system

With the essential goal is to bring faster and more convenient shopping experiences to customers, on December 16, 2013, Tamda Foods Ltd. launched new product: TamdaExpress, with official website at <https://tamdaexpress.eu/>. This online shopping service aims to provide full accessibility to store-like ranges of goods to remote customers who have access to the internet. The website displays full catalogue of more than 50,000 products and provides customers 24/7 access to make selections, orders and payments. To use the online service, customers must create an account with basic information such as name, address, phone number, passport and IČO number. The account will be reviewed and authorized before the customer can shop. After the account is created and activated, the customer can proceed to place an order. Once the order is finished, it will be processed and delivered to the customer within 24 hours inside Prague, and 48 hours for suburbia. Customers only have to pay after receiving the goods (Cash On Delivery – COD).

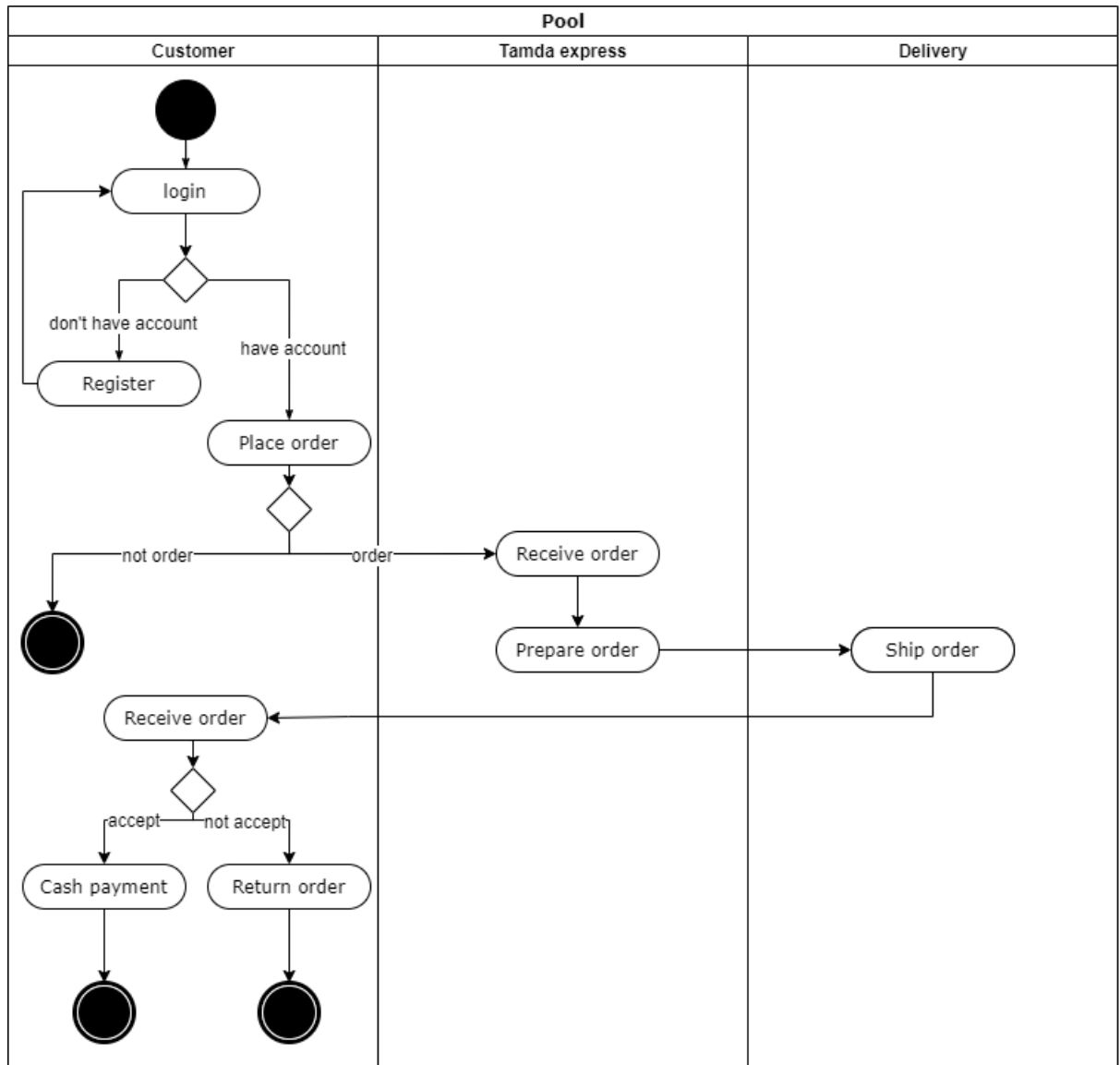


Figure 10 The current process of Tamda Foods company

1.6.3 Business requirements

Facing the current challenges, and simultaneously keeping up with the development of technology, Tamda Foods Ltd. is searching for new payment solutions that could fulfill their criteria and requirements.

- The provided payment solutions must be convenient, widely-used and bring benefits to both customers and the company;
- Payment solutions must be in accordance with the current system of the company, so that in case of implementation, it shall ensure a stable operation system;

- Payment solutions must fully meet the management and utilization demands of the company;
- Payment solutions must ensure high security and stability;
- Payment solutions must support and accept payments made in CR

1.6.4 Proposed Solutions

Based on the analysis of the challenges encountered by TamdaExpress system, as well as the aforementioned requirements from Tamda Foods Ltd., the proposed solutions for TamdaExpress system is to supplement and update additional forms of prepayment.

- Bank transfers
- e-Wallet payments (PayPal)
- Credit cards (Stripe)
- Bitcoin payments

1.7 Implementation

In this section, the proposed solutions will be tested and demonstrated on the website <https://trungnguyenviet.com/>. The payment solutions will be installed and implemented in the system (the mentioned website), before being officially put into operation in the real environment. The whole purpose of the creation of the system is to check the stability and operability of the payment methods.

1.7.1 Applied technologies

1.7.1.1 PHP

PHP: Hypertext Pre-processor, commonly abbreviated as PHP, is an HTML-embedded server-side scripting language. It is used for dynamic content management, database, session tracking, etc. PHP started out as a small open source project, but thanks to the growth of web development, more and more people found it essentially useful. PHP was developed from PHP / FI in the beginning. PHP / FI, created by Rasmus Lerdorf in 1994.

“... to say that PHP can be embedded into HTML means that you can take a standard HTML page, drop in some PHP wherever you need it, and end up with a dynamic result. This attribute makes PHP very approachable for anyone that’s done even a little bit of HTML work. Also, PHP is a scripting language, as opposed to a compiled language: PHP was designed to write Web scripts, not stand-alone applications... PHP scripts run only after

an event occurs—... PHP is a server-side, cross-platform technology, both descriptions being important. Server-side refers to the fact that everything PHP does occurs on the server. A Web server application, like Apache or Microsoft's IIS (Internet Information Services), is required and all PHP scripts must be accessed through a URL (<http://something>).” (Ullman, PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide, 2011)

According to the book, PHP is said to have cross-platform nature, means that PHP can be run on most operating systems, including Windows, Unix (and its many variants), and Macintosh. More importantly, there should be little to no modification when PHP scripts that was written on one server to work on another.

1.7.1.2 MySQL

“MySQL is the world's most popular opensource database application (according to MySQL's Web site, www.mysql.com) and is commonly used with PHP. The MySQL software comes with the database server (which stores the actual data), different client applications (for interacting with the database server), and several utilities.” (Ullman, PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide, 2011)

MySQL is based on a structured query language (SQL) that was developed, distributed and supported by Oracle Corporation. MySQL runs on almost every platform, including Linux, UNIX and Windows. MySQL is often associated with web applications.

SQL, short for Structured Query Language, which is used exclusively for interacting with databases, is a group of special words, and also believed to be easy to learn and use, and yet, amazingly powerful.

1.7.1.3 WordPress

WordPress is an Open Source Software (OSS) written in the PHP website programming language and using the MySQL database management system, which are also the most popular website programming duo today. WordPress was first launched on May 27, 2003 by Matt Mullenweg and Mike Little. Currently, WordPress is owned and developed by Automatic company, whose base is in San Francisco, California, USA. WordPress supports users to create personal blogs, and is preferred by many users for its user-friendly quality and a diversity of useful components. Over time, as the number of users has increased, WordPress' associators, who are also programmers, had involved in the development of

WordPress source code for it to gain more exclusive characters. As a result, WordPress has been considered as a superior Content Management System (CMS) that allows users to create many different types of websites such as blogs, news/magazines website, business establishment, e-commerce, including types of websites with high complexity such as hotel booking, car rental, real estate projects... Any form of small and medium scale websites can be deployed on WordPress platform. Currently, there are approximately 30% of the World's 100 largest websites utilize WordPress source code, e.g. TechCrunch, Mashable, CNN, BBC America, Variety, Sony Music, etc.

1.7.2 System information and required plugins

Webserver information

	Name	Version
1	Apache	2.4.41
2	Direct Admin	1.60.3
3	Exim	4.92.1
4	MySQL	5.6.42
5	dovecot	2.3.7.2
6	Php	7.3.9
7	Wordpress	5.3.2

Table 2: Webserver information

Plugin information

	Name	Version
1	WooCommerce	3.9.1
2	Jetpack by WordPress.com	8.2
3	Contact Form 7	5.1.6
4	Elementor	2.8.5
5	WP Mail SMTP	1.8.1
6	WooCommerce PayPal Checkout Gateway	1.6.19
7	GoUrl Bitcoin Payment Gateway & Paid Downloads & Membership	1.5.0
8	GoUrl WooCommerce - Bitcoin Altcoin Payment Gateway Addon. White Label Solution	1.3.0
9	WooCommerce Stripe Gateway	4.3.2

Table 3 Plugin information

1.8 Deploy the solution

1.8.1 Bank Transfer Payment Solutions

In order for the customers to use the bank transfer payment method, the system is required to provide customers with necessary information about their bank account, such as the following:

- Account name: beneficiary name, may be the name of an individual or a company
- Account number: a sequence of numbers under default display P P P P P P - U U U U U U U U U U U U / C C C C identifies the account owner. The value after the slash (“/”) identifies the bank that the beneficiary uses
- Bank name: the name of the bank providing the bank account
- IBAN (International Bank Account Number): a sequence of numbers identifies the account owner in the case of international money transfer used within European countries
- BIC/SWIFT (Bank Identifier Code / Society for Worldwide Interbank Financial Telecommunication): a separate code used to identify banks in case of international money transfer

Setup and Configuration

Firstly, to expedite the implementation of the bank transfer payment solution, customers shall access the payment method section: WooCommerce > Settings > Payments

Secondly, customers activate payment method (Direct Bank Transfer) and then proceed to declare information in the management section (possible to declare more than one account).

Lastly, they would complete the process by saving the information.

Payment methods

Installed payment methods are listed below and can be sorted to control their display order on the frontend.


Method	Enabled	Description	
☰ ^ ∨ Direct bank transfer – Bank Transfer	<input checked="" type="checkbox"/>	Take payments in person via BACS. More commonly known as direct bank/wire transfer	Manage
☰ ^ ∨ PayPal Checkout	<input type="checkbox"/>	Allow customers to conveniently checkout directly with PayPal.	Manage
☰ ^ ∨ GoUrl Bitcoin/Altcoins – Bitcoin/Altcoin	<input type="checkbox"/>	 Plugin Homepage & screenshots » Plugin on Github - 100% Free Open Source »	Manage
<p>White Label Product. Secure payments with virtual currency. What is Bitcoin? Accept Bitcoin, Bitcoincash, Bitcoins, Litecoin, Dash, Dogecoin, Speedcoin, Reddcoin, Potcoin, Feathercoin, Vertcoin, Peercoin, Monetaryunit payments online in WooCommerce. If you use multiple stores/sites online, please create separate GoUrl Payment Box (with unique payment box public/private keys) for each of your stores/websites. Do not use the same GoUrl Payment Box with the same public/private keys on your different websites/stores. Add additional altcoins (Litecoin/DASH/Bitcoin Cash/etc) to payment box here ></p>			
☰ ^ ∨ Stripe – Credit Card	<input type="checkbox"/>	Stripe works by adding payment fields on the checkout and then sending the details to Stripe for verification. Sign up for a Stripe account, and get your Stripe account keys .	Manage

Figure 11 Enable direct bank transfer solution

Enable/Disable Enable bank transfer

Title

Description

Instructions

Account details:

Account name	Account number	Bank name	Sort code	IBAN	BIC / Swift
☰ Viet Trung Nguyen	3999999999/0800	Česká spořitelna		CZ20080000000099999999	GIBACZFX
☰					

[+ Add account](#) [Remove selected account\(s\)](#)

Figure 12 Setup and configuration direct bank transfer solution

Result

Thank you. Your order has been received.

ORDER NUMBER: 636	DATE: March 20, 2020	EMAIL: trung0084@gmail.com	TOTAL: K&1.00	PAYMENT METHOD: Bank Transfer
-----------------------------	--------------------------------	--------------------------------------	-------------------------	---

Our bank details
Viet Trung Nguyen:

BANK: Česká spořitelna	ACCOUNT NUMBER: 3999999999/0800	IBAN: CZ2008000000009999999999	BIC: GIBACZPX
----------------------------------	---	--	-------------------------

Figure 13 Result direct bank transfer solution

1.8.2 PayPal Payment Solution

PayPal is one of the most popular payment solutions currently applied on e-commerce sites. To use this form of payment, customers are expected to have at least one PayPal account. PayPal has 2 accounts types:

- PayPal Personal is for people who participate in retail purchases, or to receive money from overseas.
- PayPal Business is the account under name of a business. This type of account is used to buy and sell goods in large-quantity (like from Ebay, Amazon ...), which also allows access to multiple users.

Setup and Configuration

To implement the PayPal payment solution, customers to access the payment method management, select WooCommerce > Settings > Payments...

Next, customers activate the PayPal payment method and declare the information in the management section.


Method	Enabled	Description	
☰ ^ ∨ Direct bank transfer – Bank Transfer	<input type="checkbox"/>	Take payments in person via BACS. More commonly known as direct bank/wire transfer	Manage
☰ ^ ∨ PayPal Checkout	<input checked="" type="checkbox"/>	Allow customers to conveniently checkout directly with PayPal.	Manage
☰ ^ ∨ GoUrl Bitcoin/Altcoins – Bitcoin/Altcoin	<input type="checkbox"/>	 Plugin Homepage & screenshots » Plugin on Github - 100% Free Open Source »	Manage
<p>White Label Product. Secure payments with virtual currency. What is Bitcoin? Accept Bitcoin, Bitcoincash, Bitcoins, Litecoin, Dash, Dogecoin, Speedcoin, Reddcoin, Potcoin, Feathercoin, Vertcoin, Peercoin, Monetaryunit payments online in WooCommerce. If you use multiple stores/sites online, please create separate GoUrl Payment Box (with unique payment box public/private keys) for each of your stores/websites. Do not use the same GoUrl Payment Box with the same public/private keys on your different websites/stores. Add additional altcoins (Litecoin/DASH/Bitcoin Cash/etc) to payment box here »</p>			
☰ ^ ∨ Stripe – Credit Card	<input type="checkbox"/>	Stripe works by adding payment fields on the checkout and then sending the details to Stripe for verification. Sign up for a Stripe account , and get your Stripe account keys .	Manage

Figure 14 Enable PayPal Payment Solution

In the PayPal checkout management section, in the API credentials, the payment method requires the declaration of API username, API password and API signature. The purpose of the declaration is to allow PayPal to communicate with Tamda Foods Ltd. e-commerce page, inform via PayPal business account of Tamda Foods Ltd.

API Credentials

To reset current credentials and use other account [click here](#).

Live API Username ?

Live API Password ?

Live API Signature ?

Live API Certificate No file chosen
No API certificate on file.

Live API Subject ?


Figure 15 Setup and Configuration paypal payment solution

In the PayPal hosted checkout settings section, users can customize PayPal’s default payment window to suit the requirements of the company, like logo adding or color editing... At the end, they would complete the process by saving the information.

PayPal-hosted Checkout Settings

Customize the appearance of PayPal Checkout on the PayPal side.

Brand Name ?

Logo Image (190×60) ? 

Header Image (750×90) ?

Page Style ?

Landing Page ? ▼

Figure 16 Setup and Configuration paypal payment solution

The PayPal API credentials are information that allows PayPal identify user as a PayPal Business account holder, which is authorized to perform API operations PayPal API credentials and only available for business accounts. PayPal owner to login to PayPal website at <https://www.paypal.com/> to request for their PayPal information. After completing the login with PayPal account, customers shall select Setting> Account Settings > Website payments > API access > manage API credential. At this point, PayPal will provide complete information about the PayPal API credentials including API username, API password and API signature.

View or remove API signature

Developers: Do not share your credential information with anyone. Store it in a secure location with limited access.

For preconfigured shopping carts: Copy and paste the API username, password, and signature into your shopping cart configuration or administration screen.

For building custom shopping carts: Store the following credential information in a secure location with limited access.

Credential	Signature
API username	Show
API password	Show
Signature	Show
Request date	19 February 2020 at 00:10:35 CET

Remove
Done

Figure 17 Setup and Configuration paypal payment solution

Result

Thank you. Your order has been received.

ORDER NUMBER:	DATE:	TOTAL:	PAYMENT METHOD:
642	March 20, 2020	K€1.00	PayPal

Figure 18 Result paypal payment solution

1.8.3 Stripe payment Solution

Stripe is a payment solution launched in 2011 in the United States offering payment solutions for e-commerce sites. Stripe is now available in 36 countries.

Setup and Configuration

To implement the stripe payment solution, users shall access the payment method management, start with WooCommerce, select Settings, then select Payments. After activating the Stripe payment method, users shall declare information in the management section.


Method	Enabled	Description	
☰ ^ v Check payments	<input type="checkbox"/>	Take payments in person via checks. This offline gateway can also be useful to test purchases.	Set up
☰ ^ v Stripe – Credit Card	<input checked="" type="checkbox"/>	Stripe works by adding payment fields on the checkout and then sending the details to Stripe for verification. Sign up for a Stripe account, and get your Stripe account keys.	Manage
☰ ^ v Cash on delivery	<input type="checkbox"/>	Have your customers pay with cash (or by other means) upon delivery.	Set up
☰ ^ v Direct bank transfer	<input type="checkbox"/>	Take payments in person via BACS. More commonly known as direct bank/wire transfer	Set up
☰ ^ v PayPal	<input type="checkbox"/>	PayPal Standard redirects customers to PayPal to enter their payment information.	Set up
☰ ^ v PayPal Checkout	<input type="checkbox"/>	Allow customers to conveniently checkout directly with PayPal.	Manage
☰ ^ v GoUrl Bitcoin/Altcoins – Bitcoin/Altcoin	<input type="checkbox"/>	 Plugin Homepage & screenshots » Plugin on Github - 100% Free Open Source »	Set up

Figure 19 Enable stripe payment solution

In the Webhook Endpoints section, Stripe requires user’s declaration to publish Publishable Key and Live Secret Key, which helps it to identify the account owners. The Webhook Secret is disclosed with the purpose of supporting Stripe to link and receive notifications from e-commerce sites. Users shall save the setting information after fully declaring the information.

Webhook Endpoints

You must add the following webhook endpoint https://trungnguyenviet.com/?wc-api=wc_stripe to your [Stripe account settings](#). This will enable you to receive notifications on the charge statuses.

Test mode Enable Test Mode

Live Publishable Key

Live Secret Key

Webhook Secret

Inline Credit Card Form Inline Credit Card Form

Statement Descriptor

Capture Capture charge immediately

Payment Request Buttons Enable Payment Request Buttons. (Apple Pay/Chrome Payment Request API)
By using Apple Pay, you agree to [Stripe](#) and [Apple's](#) terms of service.

Figure 20 Setup and configuration stripe payment solution

Installment from Stripe’s side

Webhook is managed by Stripe to contact the ecommerce site. It provides information like the payment’s status, and is used to update the order based on certain events from Stripe’s side. The access is required by the configuration at <https://dashboard.stripe.com/>, Developers section, then Webhooks, and finish with Update Details. In here user can select events such as payment, payment cancellation, etc.

Available events:

- source.chargeable
- source.canceled
- charge.succeeded
- charge.failed
- charge.captured
- charge.dispute.created
- charge.refunded
- review.opened
- review.closed
- payment_intent.succeeded
- payment_intent.payment_failed
- payment_intent.amount_capturable_updated

The screenshot shows the Stripe webhook configuration page for an account. At the top, the URL is `https://trungnguyenviet.com/?wc-api=wc_stripe`. The status is **Enabled** and the mode is **Live**. The "Webhook details" section lists the following event types: `payment_intent.amount_capturable_updated`, `payment_intent.payment_failed`, `payment_intent.succeeded`, `review.closed`, `review.opened`, `charge.refunded`, `charge.dispute.created`, `charge.captured`, `charge.failed`, `charge.succeeded`, `source.canceled`, and `source.chargeable`. The "Signing secret" section shows a secret key with a "Click to reveal" button and a "Roll secret..." button. There are also "Disable..." and "Delete..." buttons at the top right.

Figure 21 Setup and configuration stripe payment solution

Result

The screenshot shows a payment confirmation email with a blue header that says "Thank you. Your order has been received." Below the header, the order details are displayed in a table:

ORDER NUMBER:	DATE:	EMAIL:	TOTAL:	PAYMENT METHOD:
645	March 25, 2020	trung0084@gmail.com	K&1.00	Credit Card (Stripe)

Figure 22 Result stripe payment solution

1.8.4 Bitcoin payment Solution

In this project, the payment gateway of goURL and e-wallet of blockchain is proposed for the installment of a Bitcoin payment solution requiring e-wallet ownership.

Setup and Configuration

To implement the goURL Bitcoin payment solution, user visit the payment method management section, start with WooCommerce, select Settings, then select Payments, and eventually activate the Bitcoin payment method.

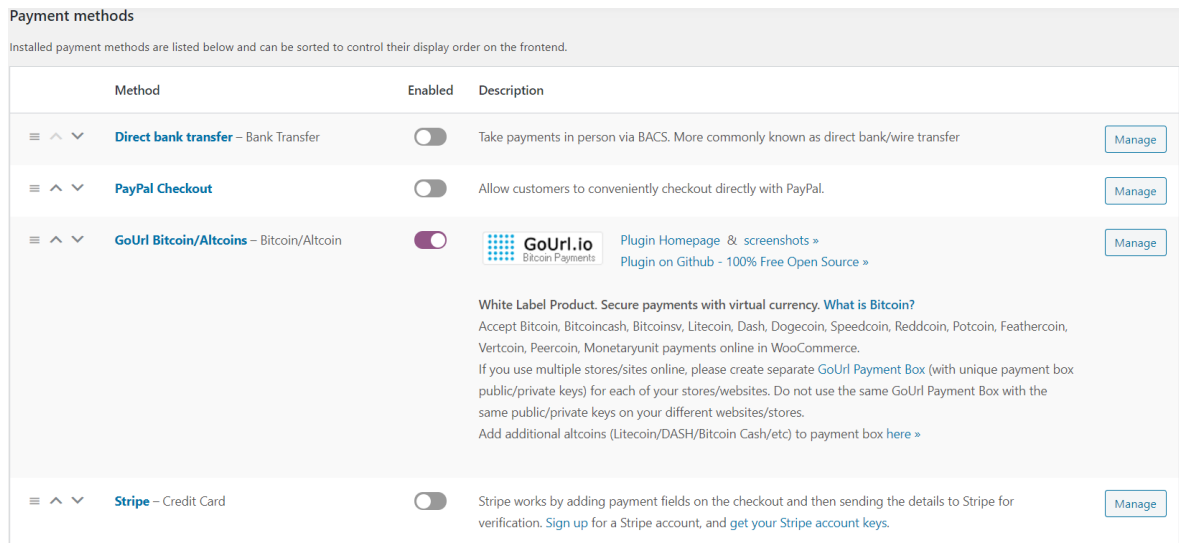



Figure 23 Enable bitcoin payment solution

After installing the plugin, users process to declare access to goURL Bitcoin. First of all, in the Settings section, user shall fill in the Callback URL field to conduct the declaration when setting up transaction. After that, the provision of Public Key and Private Key of the demanded currency, aka. bitcoin, is also requested. In addition, also in the Settings section, user can customize the payment interface to match that of the company.

[Save Settings](#)
[Instruction](#)
[Reload Page](#)

Your Callback Url: <https://trungnguyenviet.com/?cryptobox.callback.php>

IMPORTANT - Please place this url in field Callback URL for all your Payment Boxes on gourLio. See screenshot




No file chosen

Optimal size: 200x40px. Allowed images: JPG, GIF, PNG.

Free CurrencyConverterApi.com Key (optional):

if you accept payments other than USD, place free api key here. [Get free API key on currencyconverterapi.com](#) (you can use premium key also but you don't need it)

Bitcoin Payments:



GoUrl Bitcoin Box (BTC) Public Key -

GoUrl Bitcoin Box (BTC) Private Key -

Bitcoin (BTC) payments are active!

Figure 24 Setup and configuration bitcoin payment solution

GoURL payment

GoURL.io was founded in 2014, and has been known by the market for their payment solutions service as a global provider of online cryptocurrency.


With GoURL.io, vendors and consumers can perform transaction with each other with the backing of the new bitcoin/altcoin payment protocols. GoURL’s advantage is its detailed statistics yet user friendliness, open source and reliability, where website owners/vendors can directly receive bitcoins in their wallets. This means no bank account needed, and no conversion to fiat money. GoURL supports its users to convert received bitcoins to USD/EUR/etc later.

Installment from GoURL’s side

To proceed with GoURL payment, users shall visit the website <https://gourl.io/>, and login to their GoURL account. In section 2, to set up bitcoin payment for the website, user to click “Create New Payment Box for Your Website”.

2. Your Cryptocurrency Payment Box / Captcha

If you have your own website, use [PHP Class](#), [Wordpress Bitcoin/Altcoin plugins](#) or use [Payment API](#) - crypto payment box on your website -

No	Your Payment Box	Coin	Total Confirmed Payments, ~ USD	Total Confirmed Payments	Count Confirmed	Unconfirmed Payments	Unconf. Count	Latest Payment Forwarded to You	Edit
1	BTC wallet	 Bitcoin							Edit Stats

1 - 1 of 1 records

[Create New Payment Box for Your Website](#)

Figure 25 Setup and configuration bitcoin payment solution

GoURL will then ask for user's information to set up payment, such as name and demanded currency, aka. Bitcoin. The Bitcoin wallet address will be provided by blockchain, while the email address and callback URL have already been provided on website after installation.

1.	Box ID:	46995
2.	Payment Box Name: (i)	<input type="text" value="BTC wallet"/>
3.	Public Key: (i)	<input type="text"/>
4.	Private Key: (i)	<input type="text"/>
5.	Coin Name: (i)	bitcoin
6.	Type of Payment Box: (i)	paymentbox ▾
7.	Your External Wallet Address: (i)	<input type="text"/>
8.	Lock External Address Forever: (i)	LOCK FOREVER
9.	Notification By Email: (i)	<input type="text" value="nguyenviettrung0084@gmail.com"/>
10.	Callback URL: (i)	<input type="text" value="https://trungnguyenviet.com/?cryptobox.callback.php"/>
11.	Use on Adult/Gambling Website ? (i)	<input checked="" type="radio"/> No <input type="radio"/> Yes
12.	Resources / GoUrl Plugins:	<ul style="list-style-type: none"> a. Your Cryptobox Statistics » b. API - PHP, ASP, Python, Java, C#, Node.js, etc. » c. Wordpress Payment Gateway Plugin » d. WooCommerce Payment Gateway Plugin » e. WP eCommerce Payment Gateway Plugin » f. Jigoshop Payment Gateway Plugin » g. Apptthemes Payment Gateway Plugin » h. MarketPress Payment Gateway Plugin » i. bbPress Premium Membership Addon » j. Bitcoin/Altcoins Donations Addon »
13.	Record Create Time:	18 Feb 2020, 19:57
14.	Verifying it's you: (i)	<input type="text"/> Get Code

Figure 26 Setup and configuration bitcoin payment solution

Blockchain Wallet

Blockchain is a software development company founded in 2011, whose base is in Luxembourg. Blockchain offers products like Blockchain Wallet and Blockchain Lockbox, a hardware wallet. Blockchain Wallet supports multiple platforms, including computers and mobile devices, and has been rated as one of the best online wallets. Blockchain Wallet supports all popular currencies such as Bitcoin (BTC), Bitcoin Cash (BCH), Ether (ETH), Stellar (XLM) and USD PAX. By 2020, Blockchain has supported more than 140 countries, including Czech Republic.

Wallet address from Blockchain

User to access <https://www.blockchain.com/>. After successfully logging in, user to go to Settings section, select Wallets & Addresses, where Blockchain allows user to create multiple types of wallets at the same time, depending on the usage purpose. Finally, user to access to the Manage section to get the wallet address.

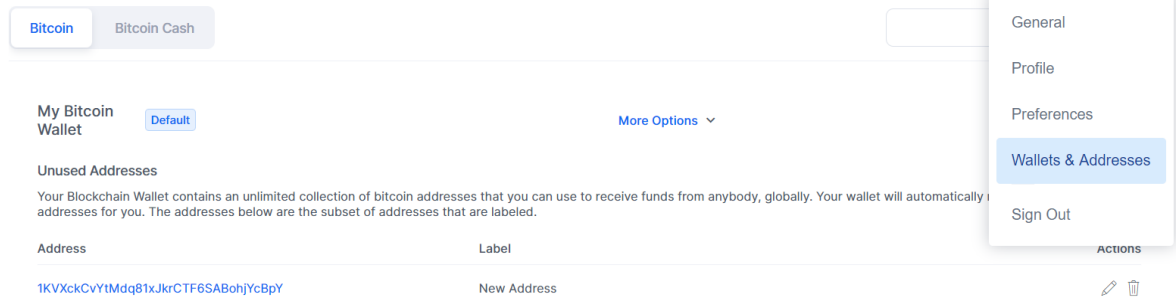


Figure 27 Setup and configuration bitcoin payment solution

Result

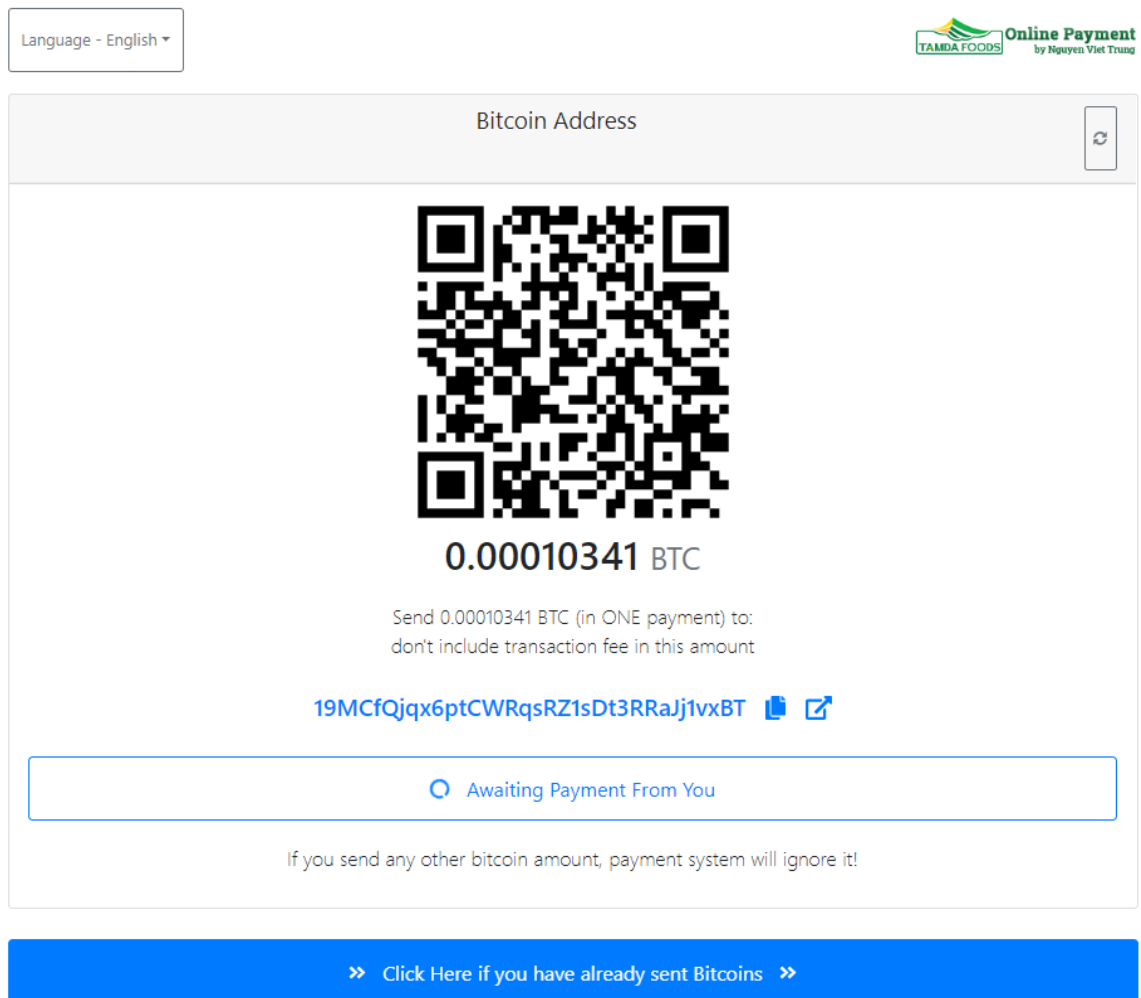


Figure 28 Result bitcoin payment solution

Results and Discussion

1.9 Analysis of payments solutions

Besides deploying and integrating the payment solutions into the system to help improve the service quality, the analysis of each payment method's benefits and cost should also be put into consideration of businesses. In this section, the advantages and disadvantages of each form of payment will be addressed, purposely providing businesses with effective management methods for each payment solution.

Most of the current payment solutions do not apply monthly fee. However, for the bank transfer payment, different monthly costs will apply depending on the bank that the business is associating with. Table 4 below provides information about the bank transfer monthly fees of some common banks in the Czech Republic.

	Monthly Fees
CSOB	Free
Ceska Sporitelna	149 kc/month
Komerční Banka	169kc/month
Raiffeisenbank CZ	100 – 400 kc/month *

Table 4 Bank transfer monthly fees in Czech Republic

* Bank clients would only pay 100kc/month if they perform at least 3 payments/month and their monthly turnover is minimum 15,000kc (otherwise they have to pay 400kc/month).

Transaction Fees

Each particular payment method will charge client with different fees for each transaction. For bank transfer payment particularly, most banks will not charge client for transferring to accounts within the same bank, and will charge from 0 - 125kc/transaction for transferring to accounts from different banks.

With PayPal payment method, each transaction is based on the Aggregate monetary amount of Commercial Transaction payments received in the previous calendar month, and from there, PayPal will apply each price level for each business. The information is shown in the following table 5

Tire	Aggregate monetary amount of Commercial Transaction payments received in the previous calendar month	Fee per payment
1	0.00 CZK – 70,000.00 CZK	3.4% + Fixed Fee(*)
2	70,000.01 CZK - 280,000.00 CZK	2.9% + Fixed Fee
3	280,000.01 CZK – 1,500,000.00 CZK	2.7% + Fixed Fee
4	1,500,000.01 CZK – 3,000,000.00 CZK	2.4% + Fixed Fee
5	above 3,000,000.00 CZK	1.9% + Fixed Fee

Table 5 Paypal transaction fees

* Fixed fee in Czech Republic is 10kc

With the applied transaction fee as the above table, the more customers use PayPal payment, the more benefits will be brought to businesses.

For payments with Stripe, the charge of fee is believed to be simpler. For transactions paid with Credit & Debit cards, Stripe applies 2.9% fee upon total payment + Fixed fee. For transactions paid with European cards, the transaction fee is significantly lower.

	Fee per payment
European cards	1.4% + Fixed Fee ^(*)
non-European cards	2.9% + Fixed Fee

Table 6 Stripe transaction fees

* Fixed fee in Czech Republic is 6.50kc

Bitcoin uses blockchain wallet for the charging of transaction fees, and this solution has no fixed fee. The cost will be calculated based on the calculation of the appropriate fee for each user's transaction, which takes into account the current network conditions and transaction size.

In addition to the monthly transaction costs, the table 7 below provides some additional information, along with the advantages of each payment method.

	Bank transfer	PayPal	Stripe	Bitcoin
Monthly Fees	0 ~ 400kc	0	0	0
Transaction Fees	Depend on bank	1.9 ~ 3.4%+10kc	1.4 ~ 2.9 + 6.5kc	N/A
Countries	180+	203	36	230

	Depend on bank			
Currencies	Depend on bank	25 ⁽¹⁾	135+	5 Cryptocurrencies ⁽²⁾ , Dollar, Euro and GBP
Card Types	Visa, MasterCard	9 ⁽³⁾	6 ⁽⁴⁾	Visa, MasterCard
Time	Less than 30 minutes for each transaction within the same bank 1 working day for each transaction with different banks	Less than 30 minutes	Less than 30 minutes	More than 1 hour for each transaction Priority fee applies

(1) Canadian Dollars, Euros, British Pounds, U.S. Dollars, Japanese Yen, Australian Dollars, New Zealand Dollars, Swiss Francs, Hong Kong Dollars, Singapore Dollars, Swedish Kronor, Danish Kroner, Polish Zlotys, Norwegian Kroner, Hungarian Forints, Czech Koruny, Israeli Shekels, Mexican Pesos, Brazilian Real (only for Brazilian members), Malaysian Ringgits (only for Malaysian members), Philippine Pesos, New Taiwan Dollars, Thai Baht, TRY for Turkish Liras (only for Turkish members), Russian Ruble

(2) Bitcoin, Ether, Bitcoin cash, Stellar, USD digital

(3) PayPal, Visa, American Express, MasterCard, PayPal Credit, Discover, JCB, Diner's Club, EnRoute

(4) Visa, MasterCard, American Express, JCB, Discover, Diners Club

1.10 SWOT analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> • The payment methods are compatible with the current system • Improve customer's payment experience, fully meet the current popular payment trends • Reduced risk of payment process than that of the previous • Numbers of customers canceling orders decreases • Increase the competitiveness of businesses 	<ul style="list-style-type: none"> • Increase product costs for some forms of payment • The requirement of creating an account in advance with prepayment services is mandatory • Some payment methods will redirect users away from the checkout page
Opportunities	Threats
<ul style="list-style-type: none"> • The ability to expand the market in the future 	<ul style="list-style-type: none"> • System is more exposed to cyber attacks

<ul style="list-style-type: none"> • Reach a wide range of customers, especially the young • The number of people using online payment is increasing over time • Increase the opportunity to implement marketing programs 	<ul style="list-style-type: none"> • Potential laws and policies change can affect the continuity of service • Potential rejection from customers because of the personal information violation concerns • In some cases, profits may be reduced due to low user usage
--	---

Table 7 SWOT

1.11 Market research result

In this section, a quick survey was conducted with 100 participants which are working and studying in Prague. The main objective of this survey is to learn about the needs and preferences of consumers, so businesses can base on the data to select and exercise suitable payment solutions. The survey was constructed with 7 questions as below:

1. What is your age?
2. Do you often shop on ecommerce sites?
3. What do you usually buy from e-commerce sites?
4. Which form of payment do you often encounter on e-commerce sites?
5. What form of payment do you often use?
6. Do you find it more convenient to use online payment?
7. Do you think diversifying payment solutions on ecommerce sites is necessary?

Question 1: What is your age?

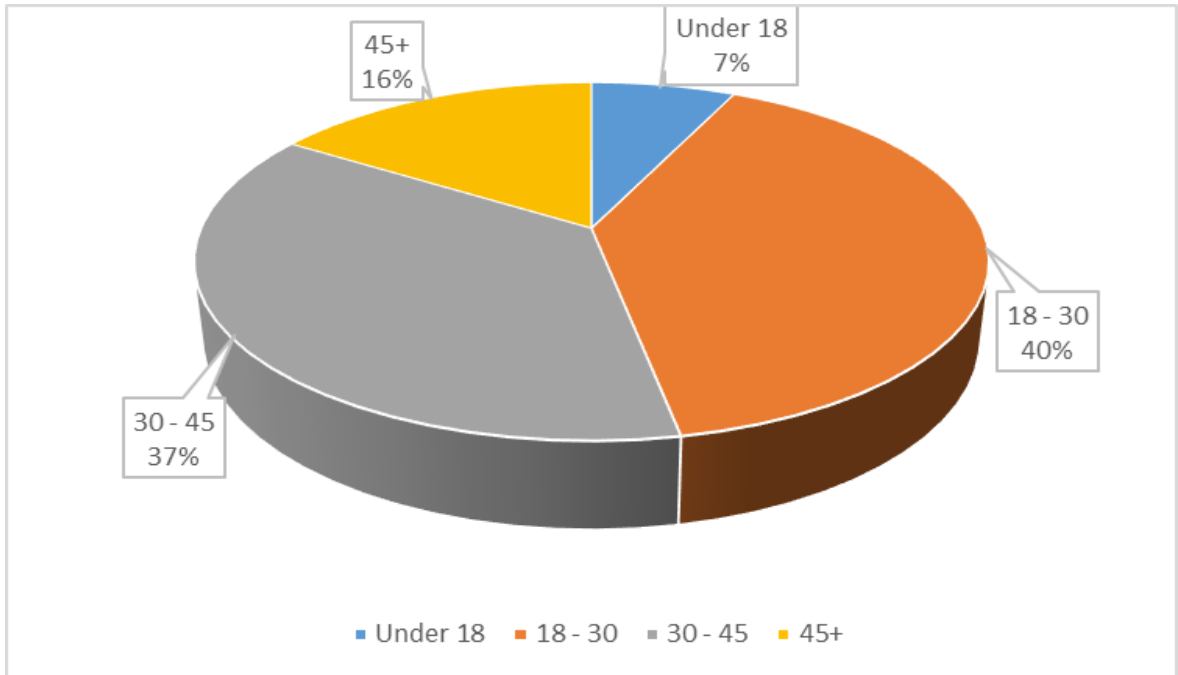


Table 8 Question 1 result

For this question, 7% of the survey respondents were under 18 years old and 16% were over 45 years old. The two most common respondent groups are 18 - 30 years old (40%) and 30 - 45 years old (37%). The purpose of this question is to determine the age of participants so that the observation and analyzation of the further data would be clear.

Question 2: Do you often shop on ecommerce sites?

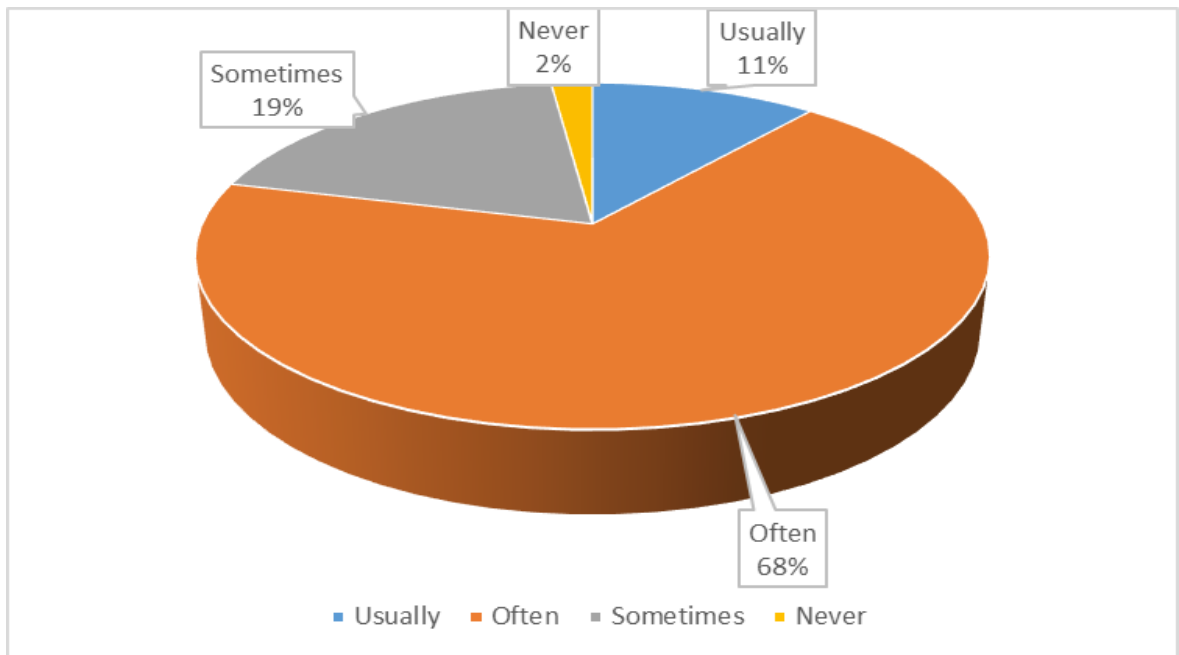


Table 9 Question 2 result

With this question, 67% of participants “often” shop online. The majority of participants response with “often” were from 18-30 years old with 33%, followed by 29% of participants from 30-45 years old. In addition, people aged over 45 is 4%, and under 18 is 2%. This shows that online shopping is becoming significantly popular in CR and is especially frequently used by working-age people.

Question 3: What do you usually buy from e-commerce sites?

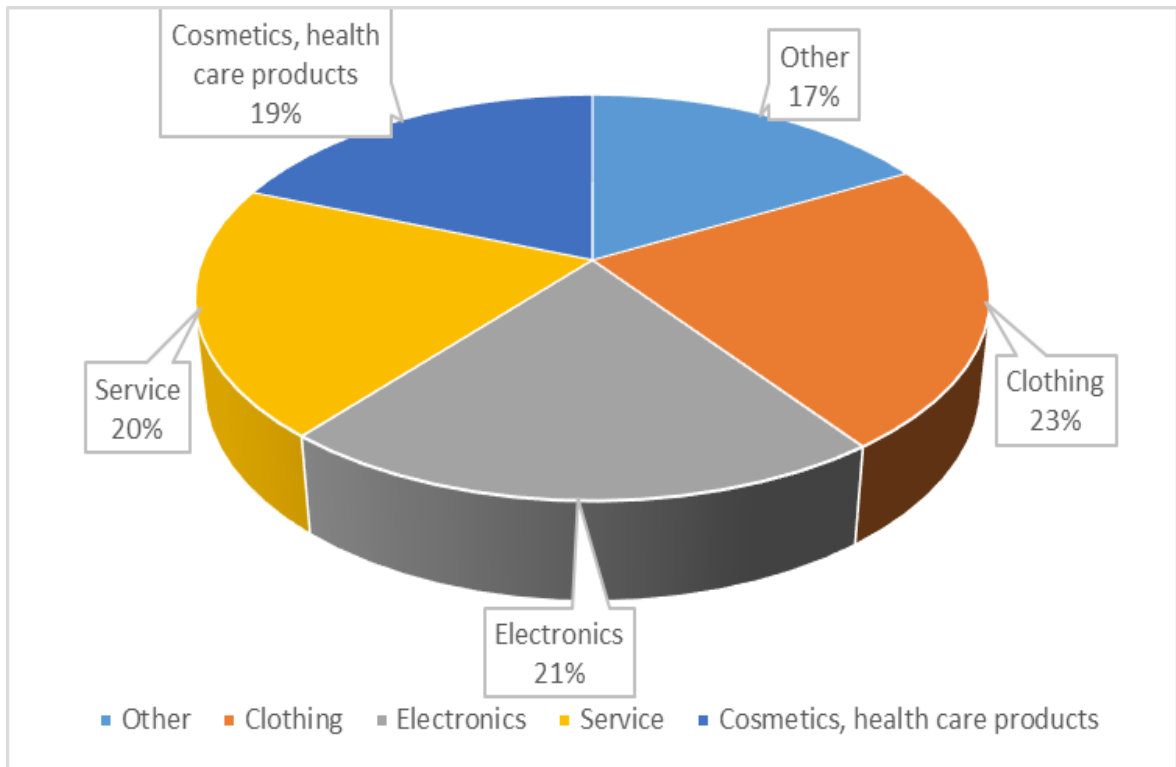


Table 10 Question 3 result

With the above survey results, we see that the categories of products sold on e-commerce sites have shared quite even portions in demands of consumers. However, Clothing (23%) and electronics (21%) are a little greater in number than the others.

Question 4 : Which form of payment do you often encounter on e-commerce sites?

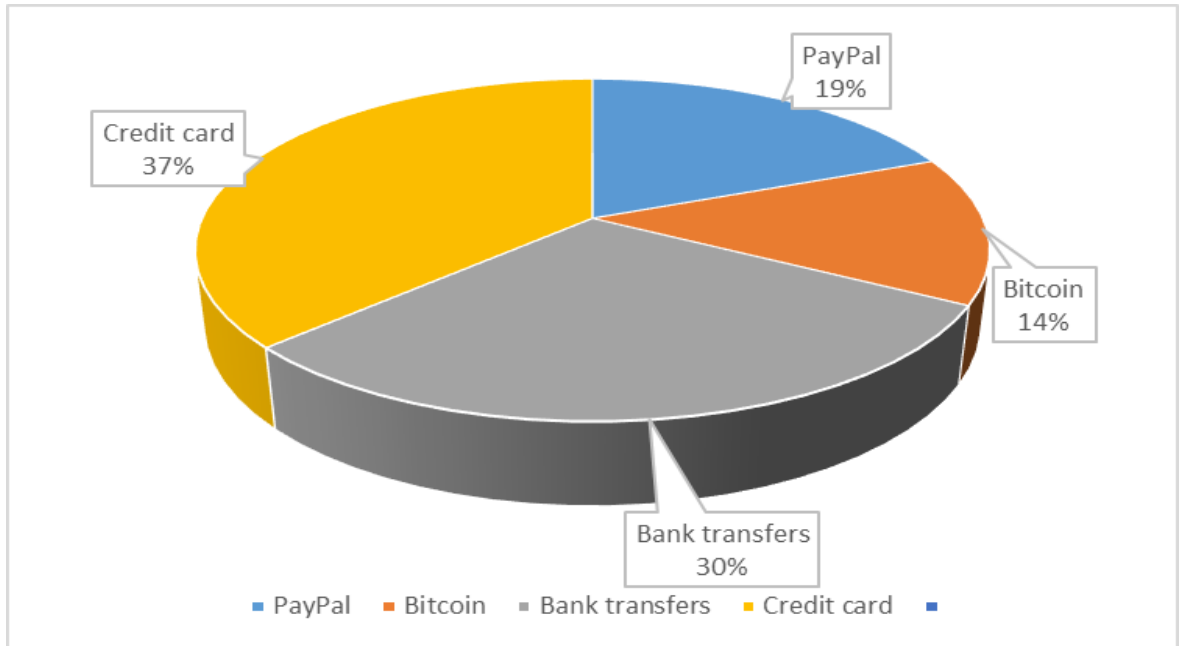


Table 11 Question 4 result

In this question, the surveyor can choose more than 1 option. The results showed that two common forms of payment that users often see on commercial websites are Credit Card and Bank transfer, which are chosen respectively 98 and 81 times, equivalent to 37% and 30%. Upon the two less popular payment methods, PayPal was chosen 52 times, and Bitcoin was chosen 38 times, equivalent to 19% and 14%. With the above data, it could be observed that existing e-commerce websites have noticed and offered new payment solutions for users, apart from traditional payment methods.

Question 5 What form of payment do you often use?

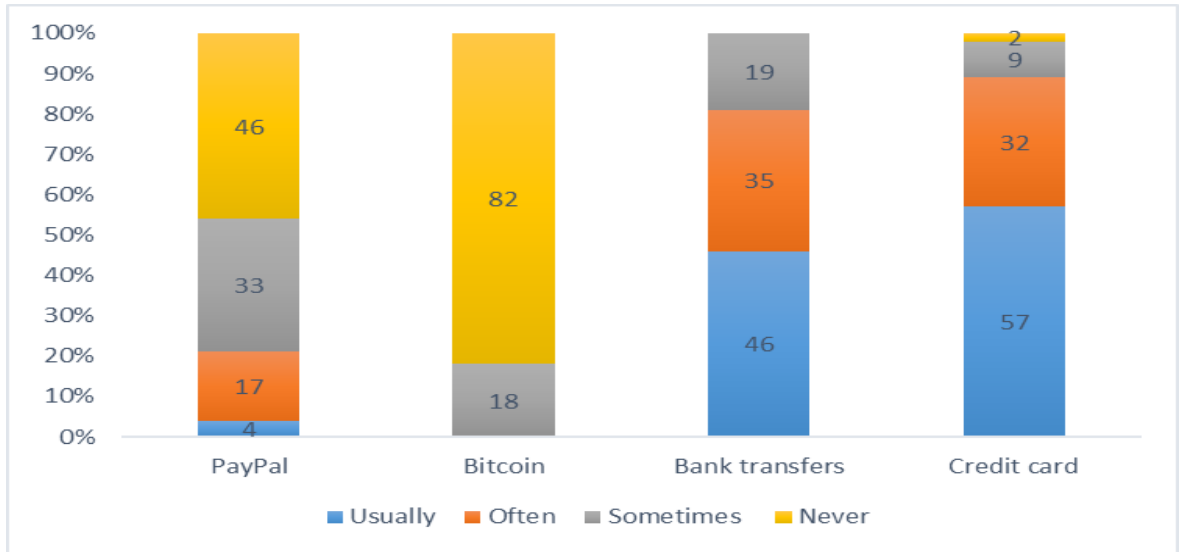


Table 12 Question 5 result

From the results of question 5, it could be seen that Credit Card and Bank transfer, which are the most chosen payment methods on e-commerce sites in Question 4, are also the most “usually” used methods by consumers. Out of 100 participants, 57 people “usually” use Credit Card and 46 people “usually” use Bank transfer. Although the number of participants chose the former is more than that of the latter, 100% of surveyors have stated that they have used Bank transfer at least once. For the other two forms of payment, the number of users is not very impressive.

Question 6 Do you find it more convenient to use online payment?

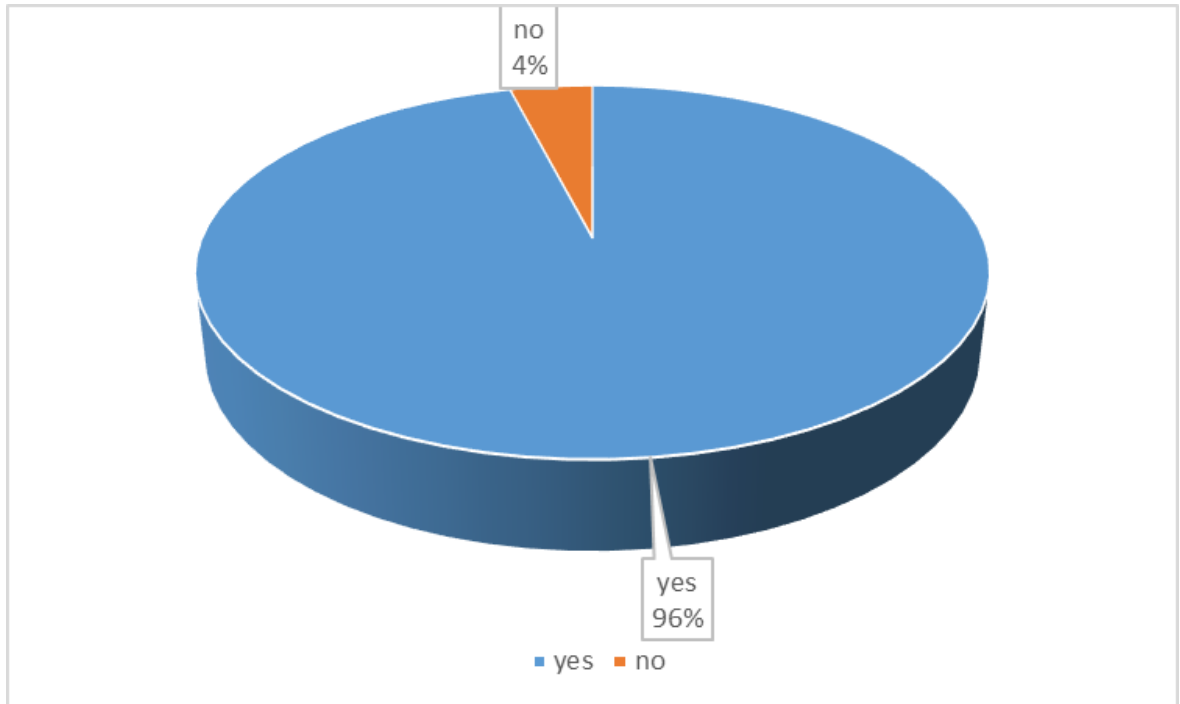


Table 13 Question 6 result

The response to this question is almost absolute with 96% saying yes. Participants think that online payment solutions make their shopping experience easier and more convenient. However, 4% of respondents who are 45+ years old returned with opposite opinions. They are anxious to provide personal information when making payment since they feel uncomfortable and unsafe.

Question 7 Do you think diversifying payment solutions on ecommerce sites is necessary?

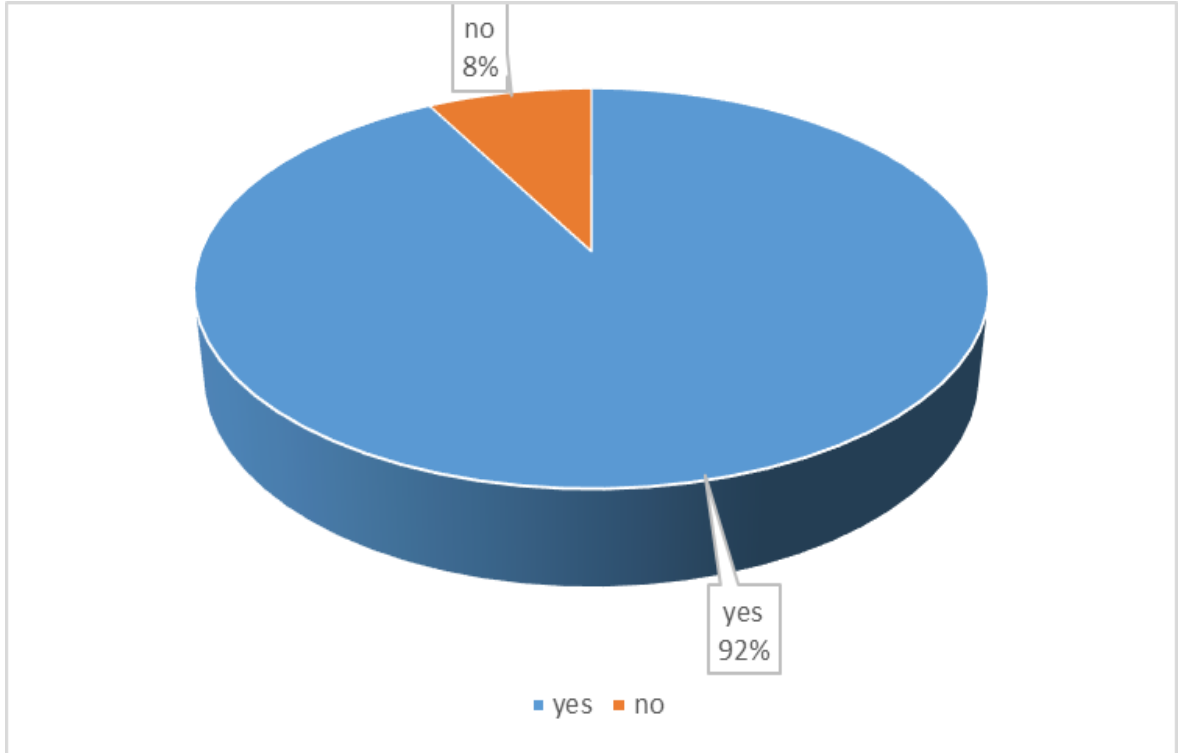


Table 14 Question 7 result

The last question was about whether “diversifying payment solutions on ecommerce sites is necessary”, 92% of respondents responded with “yes”. The majority understood that the more diverse the payment solutions are, the more options and aggression in payment the consumers will have. For the remaining 8%, they explained that various payment solutions might not be necessary, but those that could save operation cost for consumers might be.

Conclusion

Online payment solutions have contributed to the modernization of payment and transaction methods, which increases the proportion of non-cash payment in the whole economy. With the flexibility and benefits that it brings to businesses, the application of online payment solutions has been attracting the attention of businesses, especially the small ones. However, the implementation of payment solutions for small businesses has faced many difficulties and challenges to be able to improve the service quality as well as increase the competitiveness of small businesses.

This thesis aims to provide detailed descriptions and concepts, as well as how some of the most popular online payment solutions that are now available and ready for businesses to choose and implement.

Tamda Foods Ltd, in this case, is chosen to apply some of aforementioned online payment solutions. After identifying the difficulties, as well as understanding the requirements of the business, the deployment process is described in detail with configuration parameters.

Some comparisons between online payment solutions are made so that businesses can understand the advantages/disadvantages, including the cost of operation.

At the final step, a customer survey was conducted to find out the actual needs and suggestions from customers in order to find appropriate online payment solutions for some typical business models.

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Appendix

Realistic interface of the project

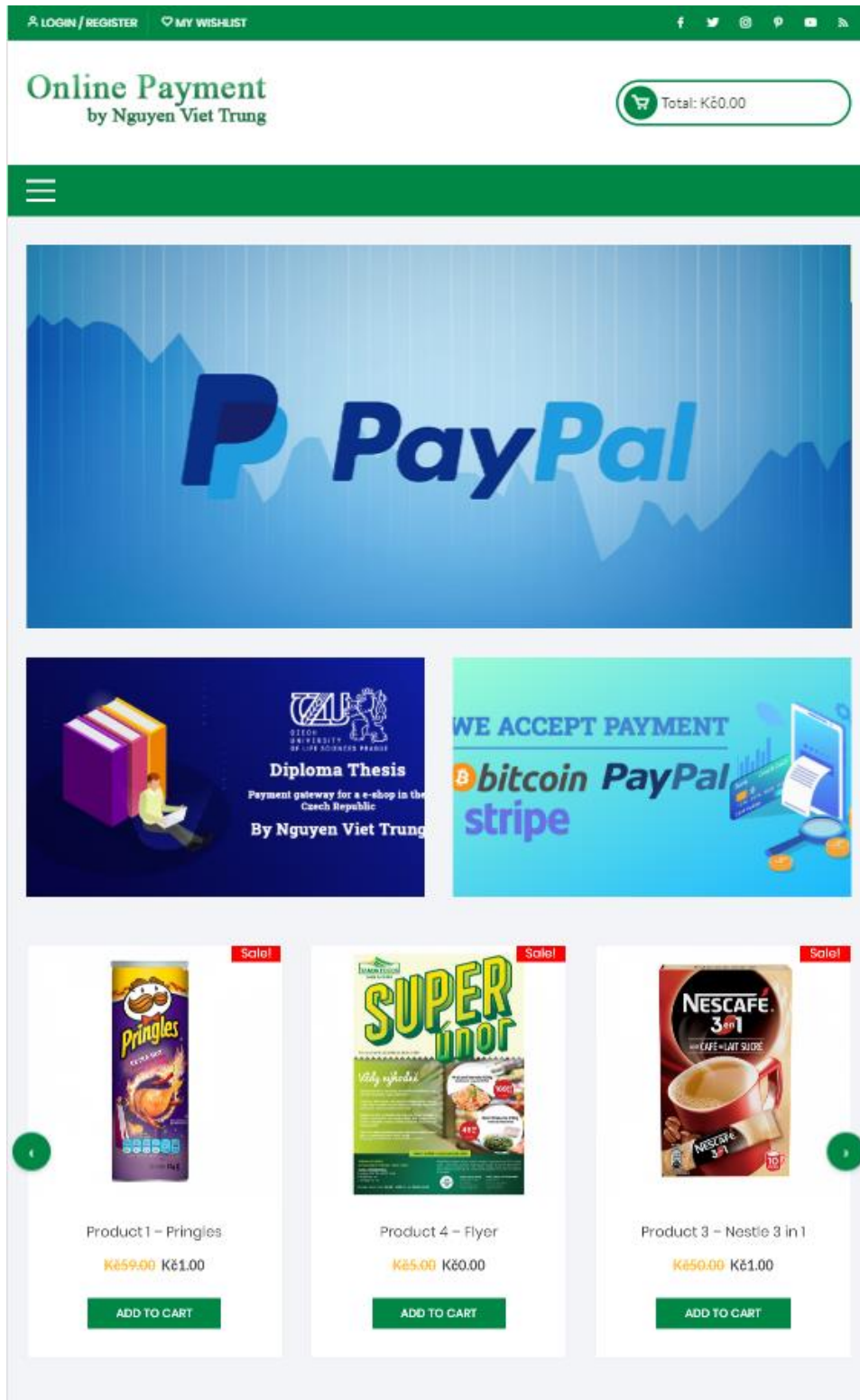



Figure 29 Project homepage by Nguyen Viet Trung


[LOGIN / REGISTER](#)
[MY WISHLIST](#)

[f](#)
[t](#)
[@](#)
[p](#)
[v](#)

Online Payment
 by Nguyen Viet Trung

 Total: K00

Sale!



Product 3 – Nestle 3 in 1

K50.00 K1.00

Category: drink
Tag: coffee

REVIEWS (0)

REVIEWS

There are no reviews yet.

Be the first to review "Product 3 – Nestle 3 in 1"

Your email address will not be published. Required fields are marked *

Your rating

☆☆☆☆☆

Your review *

Name *

Email *

Save my name, email, and website in this browser for the next time I comment.

Figure 30 Project Item page by Nguyen Viet Trung

[LOGIN / REGISTER](#) [MY WISHLIST](#)

[f](#) [t](#) [@](#) [p](#) [v](#) [m](#)

Online Payment
 by Nguyen Viet Trung

 Total: Kč1.00

CHECKOUT
[Home](#) / [Checkout](#)

[Have a coupon? Click here to enter your code](#)

BILLING DETAILS

First name * Last name *

Company name (optional)

Country *

Street address *

Town / City *

Postcode / ZIP *

Phone (optional)

Email address *

SHIP TO A DIFFERENT ADDRESS?

Order notes (optional)

Notes about your order, e.g. special notes for delivery.

Figure 31 Project checkout page by Nguyen Viet Trung


YOUR ORDER

Product	Subtotal
Product 3 - Nestle 3 in 1 *1	K₫1.00
Subtotal	K₫1.00
Shipping	Free shipping
VAT	K₫0.00
Total	K₫1.00

Cash on delivery




Pay with cash upon delivery.

Bank Transfer

PayPal 


Bitcoin/Altcoin

Credit Card (Stripe)

PLACE ORDER

ABOUT

 **Online Payment**
by Nguyen Viet Trung




Figure 32 Project checkout page by Nguyen Viet Trung