Proposed Design for Framework Management of Cryptocurrency: Study of the World's First Digital Currency

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Abstract *— The study aimed to offer design framework management system as a solution to unregulated digital currency system (cryptocurrency) to ensure safety against cybercrime, internet fraud, and breach of information through the Internet of Things (IoT). The principles and concepts of engineering management were applied in the development of the design framework for the management of Crypto currency". The fields of study in computer network system and monetary were used as bases in developing the project. The developed framework system was necessary to keep digital currency system safe while dealing with internet trading transactions by applying hybrid type method into the full adaptation of the framework system. The findings of the study revealed that the developed system ensures network security and facilities involvement. The system has a built-in feature that ensures a safe internet business transaction using digital currency.*

Keywords— *Cryptocurrency, blockchain, digital currency, IoT, e-services, e-commerce*

I. INTRODUCTION

Money is a medium of exchange for services or goods that people avail. It comes in forms of coins or banknotes. However, in this digital age, many business transactions are now being done electronically, without using physical currency, but only digital cash in the form of bits and bytes. Apparently, digital cash is gradually becoming the currency of the future.

Today, people are most commonly familiar with 'money as the medium of exchange. Countries in the world have their respective currency units for standardization. Dollar is for the US, Peso is for the Philippines, Yuan is for China, Baht is for Thailand, and many more.

The age of internet changed the way people transact, since the first coin was minted in 600 BC until it advanced to banknotes in 1661 AD and to credit card in 1946. The change requires almost everyone o have bank account because banking system offers a variety of convenient non-cash services for their clientele, such as online banking, debit card, ATM card, mobile banking, and the most recent the wireless payment or the tap payment system [2] although this is not widely used like the bill notes or check account payment that most people are familiar with.

Another milestone in human technology is the Internet of thing (IoT) creation that almost all machines have the ability to communicate with each other, give instructions and execute that instruction conveniently, leaving data logs and is more convenient compared to the earlier way of payment transactions.

Together with the developed IoT system is the invention of crypto currency. It is presumed that this technology would be the next best thing in the human monetary transaction system. However, many are hesitant to engage in transactions using crypto currency because of several issues attached to it, which includes the fact that it is classified as unregulated and therefore too risky to use.

It is believed, though, that crypto currency has greater potential than the present day money if only it will be improved, regulated and accepted as a recognized technology. That is why the researchers engaged in exploring the possibilities of crypto currency being accepted for general circulation as digital currency by designing a framework that would ensure the reliability of crypto-currency as a convenient medium of exchange. The proposed design framework could end the current monetary system and give way toward full digital currency adaptation because of IoT gaining popularity due to the advancement of technology to fits human lifestyle.

Different literature and related studies were used as basis for the conceptualization of the project.

Crypto currency may not have yet attained the degree of sophistication enough to convince the world of its usability. But it should be remembered that even the first transistor introduced in December 1947 started as a big glass envelope before it evolved to a miniature solid state that it is today with the use of diode as semiconductor device and an operational amplifier [3] for sound amplification.

Credit Cards and ATM cards at the beginning were also not as reliable and as secure as it is now that they are embedded with microchips for added security [4] against data breach through the implementation of a worldwide standard called EMV otherwise known as

Europay, MasterCard, and Visa Standard. It is a clear indication that with continuous advancement, IoT can connect anything that can be connected everything to the Internet [5]. This technology on a broader scale can be applied to things like transportation networks: "smart cities" that helps reduce waste and improve efficiency such as energy use that helps the community and improves the work and life [6]. It can also be used to create a safe and secure digital monetary system that is acceptable across the globe with the use of the following: a) application software to create text editor, web browser, or graphic editor; b) system software to keep the core system running; and firmware to permanently store components affiliated with the term computer BIOS. BIOS help startup the hardware in the computer and load up operating system [7]. With all these Crypto currency may also evolve with the use of IoT technology and in the same way transistor evolved.

However, there are challenges and opportunities to be considered about the development of Electronic Payment Systems in the Philippines. This cutting edge cashless transaction project is expected to benefit, more or less, 2.4 million overseas Filipino workers (OFW), whose remittances contribute to the country's economy.

The age of the Internet of Things (IoT) has considered the business service of e-commerce. This paper investigated the factors that influence the adaptation of the currently available electronic payment systems in terms of general, privacy, security, and trust perception, which obtained from existing literature on e-Commerce and transformed to fit the study [2].This paper provides an overview of e-commerce as a business transaction conducted over the internet that is continuously increasing and offers its customers a convenient and efficient shopping, banking, and personal finance management transactions through electronic payment, with emphasis on mobile payment that involve electronic devices connected to mobile networks. With this kind of transactions some issues reflected on paper involved the following: (a) Lack of usability; (b) Lack of security; (c) Lack of trust; (d) Lack of awareness; (e) Issues with e-Cash, (f) Users perceptions regarding the acceptance of electronic payment systems, (g) Online payment is not feasible in the rural areas and (h) highly expensive and time consuming. Using appropriate methodology used in this research, the paper was able to gather results that online transaction is way more convenient for Filipinos. Additionally the results showed that female users tend to trust the e-commerce security more than do the males. This paper provides the Philippine Government a motive in improving the use of electronic payment systems.

A Statistical Analysis of Crypto currencies. The paper provides an analysis on of the largest crypto currencies such as Bitcoin and Litecoin about statistical properties and characterizes their exchange rate versus the U.S. dollar by suitable parametric distributions. The paper generalized that for the smaller crypto currencies fits the normal Gaussian distribution generated t distribution, and Laplace distribution while for larger crypto currencies fit the generalized hyperbolic distribution [8].

Forensic-chain: Ethereum block chain based digital forensics chain of custody. This paper provides information on digital evidence in cybercrime investigation similar to link a person to criminal activities. In implementation of digital currency it is important to guarantee the integrity, authenticity, and auditable of digital evidence as it passes over different levels of hierarchy chain of custody during cybercrime investigation and the block chain technologies would provide comprehensive view of transaction (events/actions) and log back to origination that supports forensic process [9]. The paper focused on works behind blockchain system with series of a connected data structure called blocks that during the distribution on peer-to-peer network contain or tracks the logs. Each block is linked to and depend on previous block forming append chain which is permanent and irreversible data to use as a real-time audit trail for accuracy verification of records. The paper reflects that ethereum is a blockchain with a built-in Turing-complete programming language which gives the user is under decentralized applications.

The paper proposed a forensic-chain model and gave emphasize on cryptography that use for blockchain to protect the process of recording and storing of ledger within the network which creates an unimpeachable audit trail. This is the key to forensic cybercrime on how to decode the blockchain of ethereum similar to the bitcoin. The paper provides Genesis Block of Forensic Chain Model as a solution to forensic-chain blockchain ledger that helps in risk-reduction through increased trust and thus brings the promise for forensic community.

II. RESULT AND DISCUSSION

The proposed designed framework (see Figure 1) provides new technology abbreviation listed in Table 1 and its counterpart definitions, Also, some consideration in the framework is the right flow of services transaction which consider the precise flow of stages that measures and check it security in every transaction. The design focused on the development of digital currency in the Philippine to show the capability of crypto currency upon implementation with features of high secure, trusted, reliable, and available at anytime and anywhere as long as you are connected with the internet and having links accessible on the Internet of Thing (IoT).

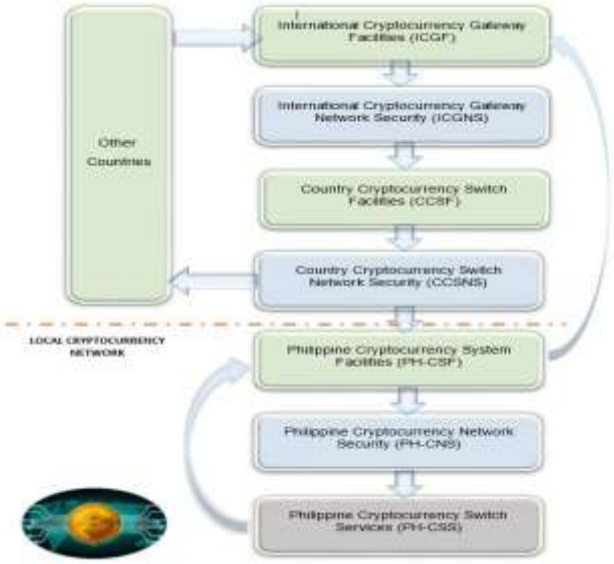

Fig. 1 Proposed Cryptocurrency Framework System

The fig. 1 is the proposed crypto currency framework system, designed under different consideration that is limited to the Philippine network access but with flow linkage in other countries. The framework consists of eight (8) stages where every stage is in right sequences in the flow direction, the backbone flow showed in one straight direction towards to a single country such as the Philippines. Every crypto currency services available to every country would have the ability to offer return flow in international gateway facilities, in any case, international services would avail through this digital currency services. This would make the transaction more secure and safe to all clients cause every stage in the framework have the feature of adapting forensic-chain feature that able to retrieve transaction information in any investigation procedure in the system.

Table 1. Design Framework Technological Abbreviation

Abbreviation	Description
ICGF	International Cryptocurrency Gateway Facilities
ICGNS	International Cryptocurrency Gateway Network Security
CCSF	Country Cryptocurrency Switch Facilities
CCSNS	Country Cryptocurrency Switch Network Security
PH-CSF	Philippine Cryptocurrency System Facilities
PH-CSN	Philippine Cryptocurrency Network Security
PH-CSS	Philippine Cryptocurrency Switch Services
Other Countries	

Newly Technological abbreviation terminologies (see Table 1) were incorporated in the design for standardization purposes and noticeable flow of each stage in the framework. This also presents the design of the catchy adaptation of the presentation. These terminologies are in sequence in the network and not suggest interchanging for it would give big changes in the flow of the design frameworks in terms of functionality. Assigning codes and symbols for a particular design is a good method for a designer to plots its technical categories and gave a sense to technical support. Framing the stages showed in a framework represent the overall design from the descriptions, function, specification, and operations of the design system.

Presentation of the Stages of the Design Framework

1.International Crypto currency Gateway Facilities (ICGF)

This frame, ICGF, is the main gateway facility where all tokens used for digital currency transaction in any country can be processed and stored, able of switch fast and offer a reliable and secure network communications. This gateway facility requires specific hardware and software capable of storing and processing large information across countries. It is a must that this frame be highly secured, supported by stable networks, and regulated in accordance to the international monetary system.

2.International Crypto currency Gateway Network Security (ICGNS)

This frame, ICGNS, is the main gateway network security where transactions using digital tokens from other countries can be processed with high level of network communications security. This network security gateway has specific requirements for software that is compatible with the hardware. The software specification of this frame requires ability to implement high-security checking of every information processed across countries. It is a must that this frame be highly secured, supported by stable networks, and regulated in accordance to the international monetary system.

3.Country Crypto currency Switch Facilities (CCSF)

This frame, CCSF, is the country switch facility where all tokens used for digital currency transaction in any country can be processed fast through a reliable and secure network communications path across countries. This switch facility has specific requirements for hardware and software compatibility. The hardware specification of this frame requires supercomputers switches that connect to other countries. It is a must that this frame be highly secured, supported by stable networks, and regulated in accordance to the international monetary system.

4.Country Crypto currency Switch Network Security (CCSNS)

This frame, CCSNS, is the main country switch network security where all tokens used for digital currency transaction in any country can be processed with high level of network communications security. This switch network requires software and hardware

compatibility and software specification that can perform high security checking of processed information across countries. This information frame suggested being offer high secure, supported by stable networks, and guided by governing bodies of the international monetary system.

5.Philippine Cryptocurrency System Facilities (PH-CSF)

This frame, PH-CSF, is the Philippine system facility where all tokens used for digital currency transaction processes switch fast through a reliable and secure network communication system in and out of the country. This system facility requires hardware and software compatibility. This frame requires supercomputers with maximum switch processing capabilities to support large transactions in the Philippines. It is necessary that this frame be highly secured, supported by stable networks, regulated in accordance to the Philippine monetary system, acknowledged by the Bangko Sentral ng Pilipinas (BSP) and subjected to the Anti-Money Laundering system (AMLC).

6.Philippine Crypto currency Network Security (PH-CNS)

This frame, PH-CNS, is the Philippine network security where all engaged token for digital currency transaction can be processed with high-level of network security within the country. This network security requires software and hardware compatibility for high-security checking of information processed in the Philippines. For this frame to be highly secured, it should be supported by stable network and must be regulated in accordance to the Philippine monetary system.

7.Philippine Cryptocurrency Services (PH-CS)

This frame, PH-CSS, is the Philippine switch services where all engaged token for digital currency transaction in the Philippines is processed through network communications with high-level switching service. This service requires compatible hardware and software with high switching specifications (see Table 2) for the Philippines. For this frame to be highly secured and efficient, it should be supported by a stable network and must be regulated in accordance to the Philippine monetary system.

Table 2. Philippine Available e-payment Services

Buy	Sell	Trading
Book Movies		Online Banking
	Online Store	Foreign Exchange
Loads		Load
Cash In		Money Sending
Mining		Bill Payment
QR Payment		Rewards
		Remittances

8.Other Countries: Crypto currency Framework System

This frame, Other Countries, is a system facility where all engaged token for digital currency transaction will be speedy through a reliable and secure network communication system in and out of any specific country. This system facility requires hardware and software compatibility, with the hardware specification requiring supercomputers and switching capabilities to support the framework of other countries. It is a must that this frame be highly secured, supported by stable networks, and regulated in accordance to the monetary system of the other countries.

The Factor in Assessing Design Framework Management for Widely and Regulated Use

There must be changes upon the implementation of the proposed design; the four primary cause involved and considered in the framework are (1) populations, security, devices, and power consumptions (see Table 6). Below show the proper sequence of four (4) factors involved and its relationship with each other based on the cycle on the Figure 2 that gave a solid foundation in assessing the design framework for widely and regulated use. The relationship of factors involved cycled in a circular direction with relations formulated in the essence of the design framework system.

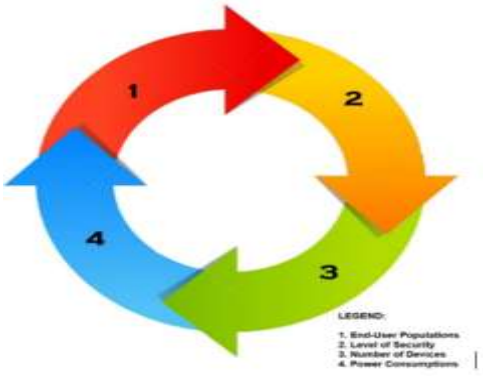

Fig. 2 Factors Involved in Design Framework Management

The relations developed in the proper sequence were the following:

1.End-User Population and Level of Network Security Relations.

In cycle period shown in Fig. 2, the relationships of these two factors population and security make sense analyzing the importance of design framework management system for digital currency. The relations are proportions with each other that when the number of end-user increases, the level of network security must be at the level high to support those populations. Relations assessment of factors population and security (see Table 4) gave importance to the subject end-user and their right to protect against cybercrime or breach of personal information.

2.Level of Network Security and Number of Devices Relations

In cycle period shown in Fig. 2, the relationships of these two factors security and devices make sense analyzing the importance of design framework management system for digital currency. The relations are proportions with each other that when the number of technological devices increases and its specifications requirements increases, the level of network security must be at level high aligned to support those increase in technological devices. Relations assessment of factors security and devices (see Table 4) gave importance to the level of security of end-user and its importance to protecting the digital currency system against cybercrime.

3.Number of Devices and Power Consumptions Relations

In cycle period shown in Figure 2, the relationships of these two factors technological devices and power consumptions make sense analyzing the importance of design framework management system for digital currency. The relations are proportions with each other that when the number of technological devices increases, the power consumptions worldwide increases and made big issues in energy resources, with this the design specification for the devices must consider with the level of power usage design. Relations assessment of factors devices and power consumptions (see Table 4) gave importance to the subject end-user and their ability to look ways of proper usage of energy for power consumption issue.

4.Power Consumptions and End-User Populations

In cycle period shown in Figure 2, the relationships of these two factors power consumption and populations make sense analyzing the importance of design framework management system for digital currency. The relations are proportions with each other that when the number of end-user increases, the power consumption also increases. This is a big issue of this generation that most are technology dependent which gave bigger factor in power usage.

Table 3. Legend Formulated in Design Framework

Factor	Description
1	End-User Populations
2	Level of Network Security
3	Number of Devices
4	Power Consumptions

Table 3 refers to the factor formulated by the researcher and use as instrument in analysing it cycles and their relation in a sequence situation. Relations assessment of factors power consumption and population (see Table 4) gave importance to the subject end-user and their ability to look ways of proper usage of energy for power consumption issue.

Table 4. Relations of Factors Involved in Design Framework

Relations	Significance
1 & 2	Population & Network Security Relations
2 & 3	Network Security & Devices Relations
3 & 4	Devices & Power Consumption Relations
4 & 1	Power Consumption & Population Relations

The Appropriate Design Plan and its Consideration in Accordance with the International Standards

In creating appropriate design plan, there should be provision for a systematic framework flow without causing conflict in any stage within the frame and in assigning standard name with corresponding color coding for the frames (see Table 5). Another critical consideration is the need to categorize the software according to function areas such as device software, network software, and the application software. This scheme would be classified as standard for producing another peripherals or support/technical consideration in the future.

Table 5. Standard Frame Name and Corresponding Colour Scheme

Colour Code	Frame Code	Frame Descriptions
Green	Facilities	Gateway, Switch, & Network Security
Blue	Network Security	Gateway, Switch, & County/PH
Brown	Services	Country/PH Switch

The Strategy to Suppress Conflict between the Digital Currency Design Framework and the Current Monetary System

The researcher proposed a hybrid policy as a strategy to suppress conflict between digital currency and the current monetary system. The strategy involves gradual integration of the design framework to the current system currently being utilized in the country until such time that the full implementation of the digital currency system shall have been reached.

The following are also being proposed to avoid conflict with the current monetary policy: 1) Block chain technology, the current policy protection of information and giving block for every transaction made; 2) Cryptography, the current policy process of recording and storing ledger which creates an unimpeachable audit trail; 3) Adaptation management of electronic payment system by merging hybrid framework solution; 4) Provision of Hardware and Software requirements to aid validation of match or mismatch issues; and 5) Network security provisions to address security issues.

Assessment of the Design Framework for Management of Crypto currency

The designed framework for management of crypto currency was assessed by 30 experts and end users consisting of Engineers and IT specialists, bankers and accountants, managers, and people engaged in making digital currency transactions. The said groups of respondents assessed the Crypto currency management system on the basis of acceptability, compliance with standards, safety and level of security, adaptability and compliance, and ease of usage.

Fig. 3 shows the percentage distribution of respondents who assessed the project.

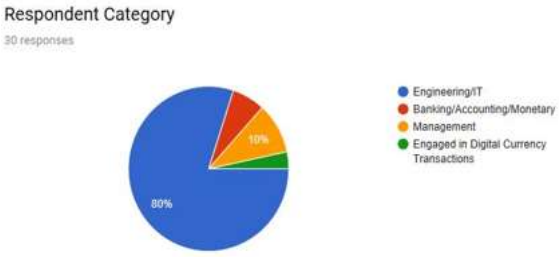

Fig. 3 Categorical Percentage of the Respondents

Assessment Findings

Table 9 shows that the overall rating obtained by the designed framework for crypto-currency management system was 4.20, which means that it is acceptable (wm=4.215), compliant (wm= 4. 14) Compliant as per result of the assessment, the assessors rated the designed framework summary of assessment results. As shown on the table, the criterion includes the mean result, remarks, and the total average is calculated as 4.20 with remark result as 'Agree'. Such agreed marks for the study reveals that it successfully achieved what the respondents would expect upon implementation of system design. All of criteria's fall on same response agreement which not divided the opinion of respondents on all selection factors.

Table 5. Evaluation Criteria of Design Framework System

Acceptability	Mean	Remark
1. The framework design in digital form uses a wide format similar to the current monetary framework. 2. The design framework is easy to assess and its technological description provides detailed design.	4.23 4.20	Acceptable (Agree)
	4.215	
Compliance to Standards		
1. The monetary scheme is under the monetary standard set in the Philippines. 2. The technical aspect of the framework design complies with the international technology standards.	4.07 4.17	Compliant (Agree)
	4.14	
Safety and Level of Security		
1. The digital system follows a safety scheme similar to that of monetary safety scheme. 2. The system provides higher level of network security for digital transactions.	4.17 4.10	Safe and secure (Agree)
	4.135	
Adaptability and Compliance		
1. The design framework equates processes similar to the current monetary process for easy adaptation. 2. The design framework provides a clear process that would not cause any confusion to the end user.	4.30 4.30	Adaptable (Agree)
	4.30	
Easy to Manage and Implement		
1. The design framework provides an easy to manage and implement process flow. 2. Involvement of professionals such as engineering profession and information technology, management professionals, banking/ accountancy/ monetary personnel, and people engaged in digital could integrate into implementation and information dissemination.	4.27 4.23	Easy and manageable (Agree
	4.20	

III. CONCLUSION AND RECOMMENDATIONS

In view of the findings, the following conclusions were established: (1) the proposed cryptocurrency management framework provides an appropriate solution to the existing problem in digital monetary system. (2) The designed framework system is acceptable based. (3)The developed design framework system provides a competent framework flow process for regulating unregulated crypto currency. (4) The framework can serve as a suitable reference for future researchers in the engineering, management, accounting, and the people engaged in digital monetary system. Based on the results and conclusion of the study, the following were offered as recommendations of the study: 1) the number of crypto currencies available is growing and it is recommended that this proposed framework following the same principle used with the US Dollar be applied for international use; 2) that this framework be implemented internationally to cater future designs, innovation, and expansion of services; and 3) that regulation of design framework adopt the

available monetary scheme model by country, tapping equivalency of international digital currency of the particular country based on its monetary exchange rate to facilitate the gradual adaptation of the system to the full implementation of the digital currency framework. The following are also recommended upon the full implementation of the framework: 1) that a monetary regulating body (BSP) by country be established to set implementation guidelines appropriate for the country; 2) that government support be ensured to strengthen its reliability; 3) that the maintenance of the design framework involve highly trained group of engineers ; and that 4) for further study, continuous improvement of the designed framework be considered to include more direct and simple [11] but advance design and most economically viable [12] higher network stability and utilization of more solid security. The OSI network layer could be used as a reference in linking all of the networks.

REFERENCES

[1] R. B. Callander, "The history of money: from barter to bitcoin," The Telegraph, 20 October 2014.

[2] M. R. Ching, "Challenges and Opportunities of Electronic Payment Systems in the Philippines," in DLSU Research Congress, Manila, 2017.

[3] R. L. Boylestad, Electronic Devices and Circuit Theory, USA: Pearson Education, Inc., 2013.

[4] D. Gray and J. Ladig, "The Implementation of EMV Chip Card Technology to Improve Cyber Security Accelerates in the U.S. Following Target Corporation's Data Breach," International Journal of Business Administration, vol. 6, 2015.

[5] M. Farooq, M. Waseem, S. Mazhar, A. Khairi and T. Kamal, "A Review on Internet of Things (IoT)," International Journal of Computer Applications (0975 8887), vol. 113, 2015.

[6] J. Morgan, "A Simple Explanation of 'The Internet of Thing", Forbes, 13 May 2014.

[7] Coursera, "Types of Software," The Course, [Online]. Available:https://www.coursera.org/learn/technical-support-fundamentals/lecture/Jrdiw/types-of-software. [Accessed April 2018].

[8] S. Chan, J. Chu, S. Nadarajah and J. Osterrieder, "A Statistical Analysis of Cryptocurrencies," Journal of Risk and Financial Management, 2017.

[9] A. H. Lone and R. N. Mir, "FORENSIC-CHAIN: ETHEREUM BLOCKCHAIN BASED DIGITAL FORENSICS CHAIN OF CUSTODY," Scientific and Practical Cyber Security Journal (SPCSJ), 2017.

[10] R.B.Callander,"The Telegrap," 20 10 2014. [Online].Available:https://www.telegraph.co.uk/finance/businessclub/money/11174013/The-history-of-money-from-barter-to-bitcoin.html.

[11] Subia, G. (2018) Comprehensible Technique in Solving Consecutive Number Problems in Algebra. Journal of Applied Mathematics and Physics, 6, 447-457. doi: 10.4236/jamp.2018.63041.

[12] Larissa Aparecida Nascimento Oliveira, Antônio de Oliveira Elízio. Comparative Analysis Of Economic Feasibility For Energy Efficiency: Dimensioning A Photovoltaic System In A Confection In Municipality Of Dona Euzebia (Mg) International Journal of Engineering Trends and Technology, 67(11),138-143.