A Secured Architecture for Transactions in Micro E-Commerce using QR scan, e-Wallet Payment Applications with Adaptation of Blockchain

Ali Waqas[1], Md. Hassam Yousaf[2], Saima Siraj[3], Usman Ahmed[4], Vidyasagar S.D.[5], Hemant J. Shinde[6] and Addepalli Lavanya[7]
[1,2,4]*School of Information Engineering, Yangzhou University, China.*
[3]*Department of Information Technology, Quest Nawabshah, Pakistan.*
[5]*Kuvempu University, Shimoga, Karnataka, India.*
[6]*National Industrial Training Institute, Kingdom of Saudi Arabia.*
[7]*Universidad Politécnica De Valencia, Spain.*

(Corresponding author: Addepalli Lavanya)

ABSTRACT: Novel corona virus outbreak started from China which has reached to every country around the world. As it is an airborne disease it spreads from person to person just by talking, coughing and sneezing within the range of below 6 feet from each other. The increasing number of cases of COVID-19 has enforced the government all across the world to take measures to impose lockdown in order to contain and combat COVID-19. The main reason of imposing lockdown was to break the chain, which can be a temporary solution and a long-lasting change in lifestyle is needed. In the wake of global pandemic there has been highly elevated used of contactless and cashless payment system during shopping. There are several methods and one of the are using QR code. QR code scan is widely used but possess cyber security threats. The objective of the paper is to propose a Blockchain based E-Wallet solution to promote contactless payment methods during shopping. The proposed system discusses the security threats of QR code payment gateway and proposes a model which enables encryption and decryption system. A blockchain architecture is proposed to save and protect the transactions at the user and merchant level.

Keywords: Blockchain; Covid19; Contactless shopping; E-commerce; E-Wallet; Micro-ecommerce.

I. INTRODUCTION

The global pandemic of novel Coronavirus has had a serious impact on the world and it continues to have massive impact on human life. Coronavirus is a virus driven by an RNA. Since it is an RNA virus, it has the ability to kill the host cell by entering the host body in order to replicate. The new Coronavirus comes from the same community of viruses that few recognized colds, in particular SARS & MERS. Corona Viruses are from the Orthocoronavirinae subfamily [1]. They belong to the Corona Viridae family and are surrounded by viruses with a positive sense of single-stranded RNA genome and nucleocapsid. Symptoms of COVID-19 can vary from person to person, but typical symptoms include fever, coughing, shortness of breath, exhaustion, chills along with trembling body aches, sore throat and diarrhea [2]. However, there have been a variety of asymptomatic cases. The initial infection was detected in Wuhan, China, in December 2019 [3].

As of Nov, 2020; About 55.5 million cases of COVID-19 in over 188 countries and territories have been registered, contributing to over 1.3 million deaths; over 34 million people have recovered [4].A number of mitigation measures have been taken by the government across all sectors, such as isolating people, wearing masks, washing hands with sanitizers, etc. [5]. The objective of the paper is to propose an architecture to enable secured contactless & cashless shopping using e-Wallet applications [6] with QR code scans and Blockchain to improve the privacy. The e-Wallet mobile application offers a range of payment facilities, such as mobile recharge, bus, flight, money transfer, train, film ticket reservation, to name a few, as the basic aim of the e-Wallet application is to provide these services to customers and to obtain a fee from the consumers.

II. BACKGROUND

Electronic commerce (e-commerce) has been described as a set of activities to carry out purchase and selling of commodities or sharing of useful data using a web enabled portal [7]. The most frequently used types of internet sites are perhaps the mobile markets, specialized e-commerce websites, mobile applications and web auctions. Digital music files, Books, high-technology products are the world's most widely available Internet market products [8]. Over the last decade, it has emerged that almost every kind of commodity can be traded online, including food and spirits [9, 10]. B2C e-commerce involving the direct selling of a business product to many prospective online buyers was according to the literature the most contested form of e-commerce. There are several other e-commerce platforms, offering different market opportunities. For instance, B2B is an e-commerce environment which aims to exchange data or products between businesses using a web portal. C2C is an e-commerce type that focuses on consumer exchanging of products. C2B is e-commerce, where consumers can sell and purchase their products online for firms [11, 12]. The paper further focuses on the B2C solution which is a setup of a physical shop using e-Wallets to facilitate the contactless payment system to avoid the spread of covid-19 at micro e-commerce i.e., at street level shopping and Blockchain is suggested to improve the privacy and overcome the security threats of QR payment vulnerabilities with cashless transactions and advanced secured transaction.

III. E-WALLET

E-wallet is a type of electronic card used for electronic device transactions or for smartphone purchases. Its

processes are the same as credit or debitcard. In order to make transfers the e-wallet must be linked to the bank account of the user. E-Wallet consists basically of two parts, software, and information [13]. The software part stores sensitive information and offers authentication and data protection. The information portion is a database of the documentation supplied by the customer, including their name, mailing address, payment process, the sum to be charged, credit or debit card details, etc.

The exponential growth of the e-Commerce market gives rise to various payment methods. Payment by e-wallet in India, China and other technically advanced countries are growing at a fast rate. The outbreak of Cvoid19 has rapidly escalated the use to contactless payment system and too many micro stores with QR scan payment system have emerged. Most users today enjoy the use of e-Wallet smartphone solutions, such as Google Wallet (Gpay), Apple Pay, Paytm, Android Pay, Airtel Pay, Jio Pay, Amazon Pay, Phone Pay, BHIM UPI, Bharat Pay among others for shopping both at micro and macro level, paying for utility and other bills, along with shopping for anything and everything[14]. One of the common reasons for the worldwide success of this e-wallet sector is that such solutions deliver quicker, more stable and trust worthy payment environments [15]. According to the survey by Worldpay's Global Payments for the year 2019-2020, the E-Wallet transaction system would top all payments with 36% of market share and will continue to rise with 47% of the share by the year 2022. In addition to this, 16 per cent of all global POS purchases were made using E-Wallets in 2018 and this is expected to hit 28 per cent by 2022. But with conscious thought of supporting contactless and cashless transaction during the pandemic the numbers have increased exponentially. This will make it the second most commonly used form of payment for PO stransactions [16].

The present-day payment ecosystem exposes a diverse scope and vision, carefully recorded by the concerned authorities. They look beyond the numbers and discuss the art and the science of paying a convincing payment pattern. Payment options other than credit and debit cards are usually considered alternative but hundreds of such alternative options are redefining the mainstream. Mobile order and pay applications for fast-service restaurants are hugely popular in the US, India, China and other countries, e-wallets account for more than half (53 per cent) of e-commerce spending in Asia. Consumers enjoy safe, frictionless checkout experience [17]. E-wallets with QR scan are offering the easy and quick experience today. It is important to account for 36% of global income, spending and to consider a wide variety of e-wallets.

China has become the world's largest consumer market, a position that we are prepared to continue to hold until 2022. India & China is accompanied by the United States and the United Kingdom in both the POS and eCommerce solutions. In terms of growth, Nigeria, Colombia and India enjoy 20% + growth rates for eCommerce, with Argentina, China and South Korea projected to see the largest gains at the point of sale [18]. The sheer scale of China's eCommerce industry is striking to $1.26 trillion in 2018. Development rates are declining slightly — to 9% by 2022 yet the lower trend would see Chinese eCommerce surpassing $1.7 trillion in five years. China's market has increasingly overtaken the desktop level, resulting in more than half of eCommerce mobile solution, a lead that is only projected to expand. The paper discusses a proposed architecture that includes E-Wallet payment system in physical shopping store and along with an advanced privacy using Blockchain.

IV. QR Code

QR codes are one of the contactless payment schematics used by most of the e-wallet payment gateways [19]. QR Codes are information hidden in a dotted image and they are so inexpensive and easy to produce [20], and that users are so willing to search them for what they show, makes the QR Code a good weapon for cyber criminals [21, 22]. Scanning the QR Code presents all of the same risks as opening a suspicious web page without some of the alerts that usually come with the above. One benefit of opening web pages is that you can see the connection you're opening, and if it doesn't look right, you can close the web page. That's not the case for QR Codes. You just point and check, and you don't even care about the risks. The danger is that the QR Code could have a malicious URL embedded and a malicious software that can be mounted on the customer's smartphone. Malware can contain the device's apps to exchange confidential information with cyber criminals. Threats for using a QR code are:
– Access to all the personal information
– Access to all the social media networks and passwords
– Access to real time location
– Possibility to Infect mobile and computer with malware.

The security and privacy risks posed by QR Codes are true [23, 24]. Luckily, reported documents of such cybercrimes are poor, with the covid19 pandemic QR Codes have started to catch up with micro ecommerce's and customers are making payments via scanning the QR codes. QR Codes could easily become a target among cyber criminals who want to manipulate unsuspected users. Payment: If the QR code is malicious, it may cause to automatically send a payment and obtain personal financial details from the user. Reveal the location of the user: the malicious Program will secretly monitor the location of the user and send this data to the app or website. There is an alarming need to incorporate layers of security [25].

V. BLOCKCHAIN

Blockchain is essentially a chain of blocks, but not in the usual sense of the word. If we use the terms "block" and "chain" in this context, we are merely talking about digital records (the "block" of data) in the shared database (the "chain"). Blocks on the blockchain consist of digital bits of knowledge and information on the previous and existing blocks attached one after the other [26]. A blockchain is best interpreted on the state-of-the-art machine replication paradigm, where a service retains certain state and customers invoke state-transforming operations and outputs. A blockchain is a trusted computing service over a distributed network protocol, connected by Internet nodes. The service reflects or generates an asset where all nodes provide valuable knowledge [27]. The nodes share a mutual purpose, but don't really trust each other for more. Blockchain models are allowed to monitor who participates in validation and in the protocol, usually defined and formed a consortium [28]. An integrated blockchain technology by defining and introducing an

open cross-cutting standard framework for distributed environment leads can change the global business transactions [27]. Online payment and transaction are exclusively related to financial entities who serve as trustworthy third parties who handle and mediate the electronic transaction [29]. The task of trustworthy third parties is to verify, safeguard and manage transactions. A certain amount of theft is possible in internet purchases and has to be mediated by financial transactions. There is high possibilities of financial frauds and other risks involved in online purchases and cashless transactions [30].

Cryptography is the backbone of the blockchain. The role of cryptography is to strengthen the security which eventually increases privacy for both user information and the collection of transactions performed [31]. The hash functions are used in the security part of blockchain and are represented as:

$$h: \{0,1\} * \rightarrow \{0.1\}n$$

Equation 1: Cryptography Hash

The pictorial presentation of the blocks connecting with hash "h" as shown in Fig. 1.
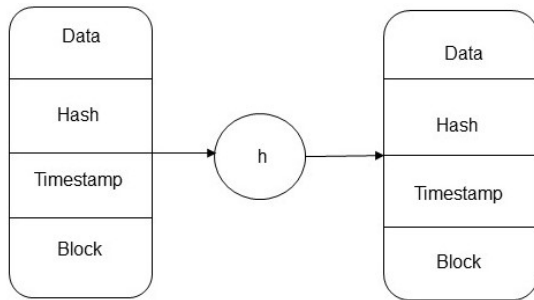
Fig. 1. Block Chain Architecture [30].

Every block in the blockchain is a decided and structed set of data, a hash code of current and previous block, the timestamp when it was created and also the note of time when it was updated with modification of data. It is decentralized data access where all the involved parties have access to the documents [30].

As Bitcoin was once upon a time the most popular blockchain application technology, but blockchain can be used in a wide variety of applications far beyond cryptocurrencies [28]. As it enables transfers to be made without any bank or broker, blockchain can be used in different financial applications such as digital properties, remittances and online payments [32]. Additionally, blockchain technology is now one of the most exciting disruptive innovations for the next phase of internet connectivity platforms, such as smart contracts, public utilities, Internet of Things (IoT), reputation systems and protection services and the list keep going on by evolving the smart and intelligent technology year by year [33].

While shopping at the local grocery store or at street vendors selling vegetables and fruits. During the world pandemic time where being contactless is the safest and encouraged way of lifestyle. The alternative to paper and coin physical currency substitutes to a traditional wallet with a wireless wallet built into a current electronic system, such as a smart phone [34]. This digital wallet allows the user to carry a digital cash and identity documents [35]. The digital documents can be searched quickly with name and other keywords. In addition, they can be managed with the right software much more effectively. Blockchain hash encryption will

secure the data in the digital wallet and stable solutions, making the recovery quick [36]. However, the idea of a digital wallet is not new at all. Japan and South Korea have both introduced cashless wallet smart phone solutions. In those countries, customers will use their cell phones to pay for food, order drinks from a dealer and even identify themselves at airline ticket counters. Other nations, such as Sweden, are expected to carry out digital wallet-type solutions in the coming years. The next section of the paper discusses the proposed system.

VI. PROPOSED MODEL

The proposed e-wallet architectural model is explained as contactless and cashless transaction at micro level physical store and street vendors [34].

The scenario can be explained as a person "A" is visiting a physical store "S". The person "A" after his/her shopping when they have to make payment. In the pandemic situation when everything around is at risk and touching anything and everything could be potentially contaminated. The person "A" takes his/her phone to scan the QR code pasted on the board. The QR code has the vendor's E-Wallet code embedded. Which when scanned connects to the payment system and the person "A" can make the payment with the amount preloaded onto the E-Wallet. Once the payment is through an automated invoice and receipts are generated which are sent to both vendor and the customer. Here blockchain plays the role of giving customer a privacy of keeping his transaction and receipts to preserve the record of purchases.

The emblematic black and white square pattern of the QR code. The increased proliferation of smartphones and connected to high-speed Internet also contributed to the massive adoption of QR codes. That's why we see it nearly everywhere, if it's for shopping, traveling, movies, eat outs, and etc [37]. According to Statista report, more than 11 million population only in the USA will be scanning the QR code by the end of 2020. This figure is well over 9,76 million scans registered back in 2018. With the global spread of pandemic, the numbers are expected to increase.
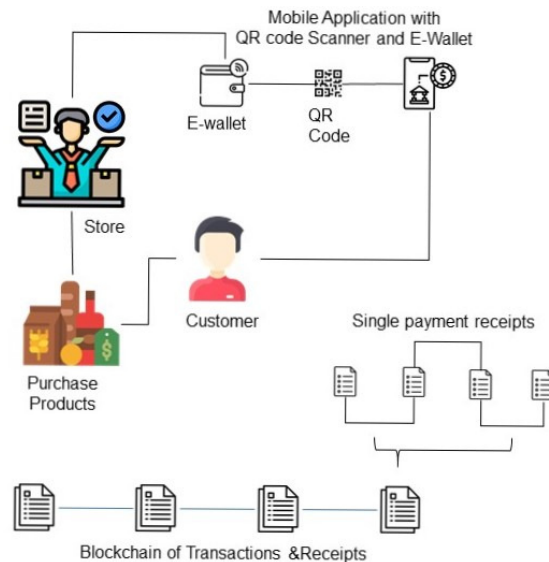
Fig. 2. Ecommerce Architecture with Cashless Transactions.

Nowadays, there is also a range of QR code search applications available that enable users to search QR codes as quickly as possible. All the consumer needs to do is open the camera and position it in the direction of the QR code; this will automatically mark the camera and then open the payment gateway [38]. The consumer only needs to tap and enter his security code to finish the payment process. There are many money and banking software's and solutions for both mobile and desktop application that can process QR codes for money transfer, purchases, sales and other money related purposes [39].

Explains the architecture with a physical store selling the goods and groceries. A customer arrives to make his purchased and uses his phone with camera to scan the QR code and then proceeds with entering his security pin and the payment process is executed swiftly. In this proposed system the vendor centric Blockchain is encouraged as the store owners create the invoice and later gives the receipts.
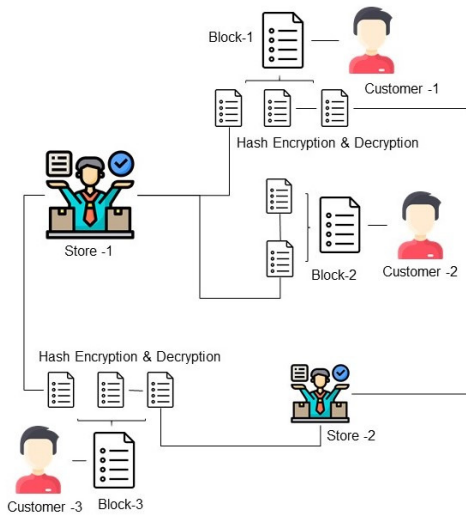

Fig. 3. Blocks of Payment Transaction.

The Fig. 4, Explains the blocks and the chain of blocks from different vendors and different customers. The vendor centric blockchain is where every vendor has their own set of database and only partial information is shared with others. Here the sharing in decentralized fashion is carried out with protecting the invoices, transaction information and payment receipts.

The Fig. 4 explains the flow of the system and the transactional details are stored in the cloud at the vendor side. In most of the cases the E-Wallet is the third-party payment catalyst between the bank and customer and the vendor. The vendor uses a cloud database or other cloud storage for his micro eCommerce solution and the payment is carried out using E-Wallet. Cloud storage application and file systems such as Dropbox, Google Drive or One Drive to name it are becoming more popular for document storage, images, video and music files. Given their success, cloud file storage technologies usually face challenges in areas such as security, privacy and data control. The key problem is that one would trust a third party for one's private files. The proposed system is precisely designed for micro vendors, small stores and street vendors so they cannot invest in heavy software infrastructure. The use of free and economic cloud storages that are pocket friendly for every vendor.
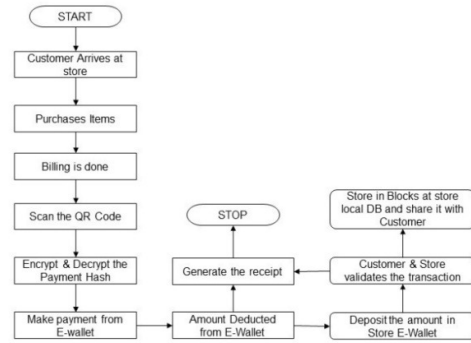

Fig. 4. Flow Chart of Proposed System.

VII. CONCLUSION

Most of the previous work in this field involved electronic payments the usage of mobile phones is a convenient alternative for a credit card or smart card or debit card and also cash. The idea suggested is intended to shift the perception that a mobile wallet application is just a surrogate for cash or card payments. The solution is to build a convenient hassle-free mechanism to enable the users to make micro transfers at street level; move the funds as quickly and conveniently as they can from their own traditional wallets and pockets. The whole transaction will also be stable, traceable, and simple to check. Blockchain allows a secured payment transaction overcoming the threats posed by open QR code payment methods. The future scope of the paper is to strengthen the QR code by adding an additional layer of security to identify only the QR code and no other information of customer is to be shared.

VIII. FUTURE SCOPE

The future cope of the paper is to develop dynamic and unique QR codes by the merchants and every customer is expected to make payments by scanning a unique QR code.

REFERENCES

[1]. Pham, Q. V., Nguyen, D. C., Hwang, W. J., & Pathirana, P. N. (2020). Artificial Intelligence (AI) and Big Data for Coronavirus (COVID-19) Pandemic: A Survey on the State-of-the-Arts.
[2]. Nishiura, H., Oshitani, H., Kobayashi, T., Saito, T., Sunagawa, T., Matsui, T., & Suzuki, M. (2020). Closed environments facilitate secondary transmission of coronavirus disease 2019 (COVID-19). *MedRxiv*.
[3]. COVID, T. C., & Team, R. (2020). Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19)-United States, February 12-March 16, 2020. *MMWR Morb Mortal Wkly Rep, 69*(12), 343-346.
[4]. Zu, Z. Y., Jiang, M. D., Xu, P. P., Chen, W., Ni, Q. Q., Lu, G. M., & Zhang, L. J. (2020). Coronavirus disease 2019 (COVID-19): a perspective from China. *Radiology*, 200490.

[5]. Yue, X. G., Shao, X. F., Li, R. Y. M., Crabbe, M. J. C., Mi, L., Hu, S., & Dong, K. (2020). Risk Prediction and Assessment: Duration, Infections, and Death Toll of the COVID-19 and Its Impact on China's Economy. *Journal of Risk and Financial Management*, *13*(4), 66.

[6]. Revathy, C., & Balaji, P. (2020). Determinants of Behavioural Intention on E-Wallet Usage: An Empirical Examination in Amid of Covid-19 Lockdown Period. *International Journal of Management (IJM)*, *11*(6).

[7]. Kim, H., & Niehm, L. S. (2009). The impact of website quality on information quality, value, and loyalty intentions in apparel retailing. *Journal of interactive marketing*, *23*(3), 221-233.

[8]. Rafiq, M., Fulford, H., & Lu, X. (2013). Building customer loyalty in online retailing: The role of relationship quality. *Journal of Marketing Management*, *29*(3-4), 494-517.

[9]. Bresciani, S., Giacosa, E., Broccardo, L., & Culasso, F. (2016). The family variable in the French and Italian wine sector. *EuroMed Journal of Business*, *21*(1), 101-118.

[10]. Bresciani, S., Ferraris, A., Santoro, G., & Nilsen, H. R. (2016). Wine sector: companies' performance and green economy as a means of societal marketing. *Journal of Promotion Management*, *22*(2), 251-267.

[11]. Wang, T. S., Wang, Y. S., & Liu, E. R. (2016). The stickiness intention of group-buying websites: the integration of the commitment–trust theory and e-commerce success model. *Information and Mangement*, 625-642.

[12]. Faraoni, M., Rialti, R., Zollo, L., & Pellicelli, A. C. (2018). Exploring e-Loyalty Antecedents in B2C e-Commerce Empirical results from Italian grocery retailers. *British Food Journal Emerald Publishing Limited*, 574-589.

[13]. Schafer, B. J., Konstan, J., & Riedl, J. (1999). Recommender Systems in E-Commerce. *ACM*, 158-166.

[14]. Kumar, S. V., & Kavya, C. (2020). Role of Unified Payment Interface in Digital Banking Services–An Empirical Study on User Perceptions. *Mukt Shabd Journal*.

[15]. Alhafi, R., Almutairi, S., Alsultan, N., Alsmadi, M. K., Alshabanah, M., Alrajhi, D., & Almarashdeh, I. (2019). E-Payment and Transactions using QR Codes. *International Research Journal of Engineering and Technology*

[16]. Huang, P. C., Chang, C. C., Li, Y. H., & Liu, Y. (2020). Efficient QR code secret embedding mechanism based on Hamming code. *IEEE Access*, *8*, 86706-86714.

[17]. Anwar, N., Rasjidin, R., Stephanus Najoan, D., Rolando, C., & Hendric Spits Warnars, H. L. (2020). E-payment for Jakarta Smart Public Transportation, Using the Point System for E-Commerce. In *Journal of Physics: Conference Series*.

[18]. Manurung, E. A. P. & Lestari, E. A. P. (2020). Kajian Perlindungan E-Payment Berbasis Qr-Code dalam E-Commerce. *Jurnal Penelitian dan Pengembangan Sains dan Humaniora*, *4*(1), 28-36.

[19]. Tyler, D. W., Isenhart, J., Mueller, A., & Sadil, C. (2017). *U.S. Patent No. 9,852,417*. Washington, DC: U.S. Patent and Trademark Office.

[20]. Soon, T. J. (2008). QR code. *Synthesis Journal*, 59-78.

[21]. Narayanan, A. S. (2012). QR codes and security solutions. *International Journal of Computer Science and Telecommunications*, *3*(7), 69-72.

[22]. Krombholz, K., Frühwirt, P., Kieseberg, P., Kapsalis, I., Huber, M., & Weippl, E. (2014). QR code security: A survey of attacks and challenges for usable security. In *International Conference on Human Aspects of Information Security, Privacy, and Trust* (pp. 79-90). Springer, Cham.

[23]. Zhu, X., Hou, Z., Hu, D., & Zhang, J. (2016). Secure and Efficient Mobile Payment Using QR Code in an Environment with Dishonest Authority. In *International Conference on Security, Privacy and Anonymity in Computation, Communication and Storage* (pp. 452-465). Springer, Cham.

[24]. Yin, S., Sheng, J., Wang, T., & Xu, H. (2018). Analysis on Mobile Payment Security and Its Defense Strategy. In *International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing,* 941-946. Springer, Cham.

[25]. Kumar, R., Kishore, S., Lu, H., & Prakash, A. (2020). Security Analysis of Unified Payments Interface and Payment Apps in India. In *29th {USENIX} Security Symposium ({USENIX} Security 20)* (pp. 1499-1516).

[26]. Swan, M. (2015). Blockchain, O'Reilly Media, Inc.

[27]. Cachin, C. (2016). Architecture of the hyperledger blockchain. *IBM Research, Zurich.*

[28]. Crosby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). Blockchain technology: Beyond bitcoin. *Applied Innovation*.

[29]. Risius, M., & Spohrer, K. (2017). A Blockchain Research Framework. *Bus. Inf. Syst. Eng.,* 385-409.

[30]. Abadi J., & Brunnermeier, M. (2018). Blockchain Economics," National Bureau of Economic Research, Cambridge, MA.

[31]. Gupta, S. S. (n.d). Blockchain. Indian Statistics Institute, Kolkata, West Bengal, India.

[32]. Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. *International Journal of Web and Grid Services*, *14*(4), 352-375.

[33]. Nofer, M., Gomber, P., Hinz, O., & Schiereck, D. (2017). Blockchain. *Bus. Inf Syst. Eng.,* 183-187.

[34]. Haxhimehmeti, H., & Besimi, A. (2020). Prototyping Micropayment Mobile Platform using QR Codes. In *2020 9th Mediterranean Conference on Embedded Computing (MECO)* (pp. 1-5). IEEE.

[35]. Rizaldi, A., & Faruqi, F. A. (2020). Electronic Wallet as a Payment Transaction Instrument. In *IOP Conference Series: Materials Science and Engineering*.

[36]. Aysan, A. F., & Bergigui, F. (2020). Blockchain Paths in Rebooting the Global Response to the Sustainable Development Goals after COVID-19.

[37]. Pandiarajan, V., Commons, W. D., Patnam, S., Ghoshal, J., & Kannamangalam, R. (2020). *U.S. Patent No. 10,769,625*. Washington, DC: U.S. Patent and Trademark Office.

[38]. Kavitha, K., & Kannan, D. D. (2020). Factors Influencing Consumers Attitude Towards Mobile Payment Applications. *International Journal of Management*, *11*(4).

[39]. Yan, L. Y., Tan, G. W. H., Loh, X. M., Hew, J. J., & Ooi, K. B. (2020). QR code and mobile payment: The disruptive forces in retail. *Journal of Retailing and Consumer Services*, *58*, 102300.