

Application of a Multiple Carrier Cashless Payment System for Public Transportation in Metro Manila: A New Normal Perspective

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Abstract

Public transportation provides a cost-effective commute for people to reach their destination. In the Philippines, it is dominated by road vehicles such as jeepneys, taxicabs, Asian utility vehicles, and tricycles, with most if not all, commuters go via multiple carriers for the daily routine. The highly contagious coronavirus has put the world on high alert when it comes to touching high contact public surfaces. When it comes to paying for public transport services by cash, contact is inevitably unavoidable. Recent studies have concluded that the coronavirus can persist on inanimate surfaces like metal, glass or plastic for up to 3 days depending on the conditions. Interest would be on how drivers and passengers can be protected in the age of coronavirus and beyond. With the growing concern over the safety of drivers and commuters, it would be much advisable to use contactless payments to reduce the risk of transmission. With no obvious end to the outbreak in sight, the study delved on the feasibility of applying the cashless payment system for the multi-carrier commuting public. Results provided a better understanding of the complexities, issues, requisites and benefits of a Multi-Carrier Contactless Payment System for public transportation and all its stakeholders.

Keywords

Public Transportation, Multi-Carrier Contactless Payment System

1. INTRODUCTION

1.1 Background of Study

Transportation is a process of transferring people or goods from one point to another by which such movement is required as it provides accessibility, improves business activities of goods and services (The Editors of Encyclopedia Britannica, n.d.). Metro Manila occupies a total land area of 620 km² and supports 12 to 15 million due to the movements of nearby provinces as of the year 2012 (Varsolo Sunio, 2017). The mobility does have a transportation mix from private vehicles to public vehicles such as buses, taxis, and the commonly used and locally know Filipino vehicles or an Asian Utility vehicle that are jeeps or jeepneys and tricycles (Boquet, 2017). The Philippines received a big dent in its economy due to the rise of the COVID-19 pandemic. All modes of transportation halted, people were not able to move from one place to another, jobs were stopped, and the way how people work changed. Transportation of people and goods was radically reduced, supply chains were disrupted, businesses closed, the stock market collapsed, and unemployment soared; exponentially growing the worldwide economic crisis. (Capra, 2020)

Due to the pandemic, the use of the cashless system is inevitable, a solution made to reduce and minimize direct physical contact between people in avoiding the rapid spread of the virus. DOTr mentioned that they will be of utilizing a system called Automatic Fare Collection System (AFCS) along with the electronic toll collection. For those passengers who are not fortunate in applying the AFCS, they are required to pay the driver in cash before boarding.

1.2 Rationale and Scope of the Study

The research study covers the Metro Manila PUV system of routes and carrier types that are legally registered and/or allowed by the Land Transportation Office of the Philippine Department of Transportation. This study will not cover the rail transit system and waterway carriers. With the limitation due to covid restrictions on face-face meetings, literature review, online interviews and surveys will be carried out for data gathering purposes to enable a systems-intensive study in this regard.

1.3 Aim, Objectives and Value of the Study

The aims of this study is to profile the different PUVs and its users, owners, and payment system; assess the payment system areas requiring cash transactions where a contactless payment system can be implemented; develop alternative contactless payment schemes considering the peculiarities of PUV ownership and operation and the different ride preferences and paying habits of the commuting public, and to recommend a suitable contactless payment system platform that will streamline the complexities associated with the use of multi-PUV commuting system in Metro Manila.

Its results of the study benefit the PUV riding public to have an alternative contactless payment system in view of the pandemic protocols and health concerns. Also, the government sector gains a better understanding of the challenges and opportunities if and when a cashless payment system is pursued in the long run. The study will also help PUV owners and operators in terms of a conceptual framework for dissemination to PUV groups of drivers at a later time when such a scheme will be pushed for implementation. Other stakeholders like systems developers and investors can benefit as well from the results that can influence service innovation and entrepreneurial exercises.

2. LITERATURE REVIEW

Companies such as Grab and Lalamove immediately applied the countermeasures implemented by the government to assure the safety of both the operator and the passenger which will significantly help in preventing the spread of the virus. The payment system used by both parties is the e-payment via online booking system in which transaction is being done by the use of each company's dedicated mobile application (may it be android or iOS). The process starts with the passenger in which they will first open the mobile application of either Grab or Lalamove, the passenger types in their current location and the destination point, that the passenger will tap on the book now button, the application will then search for available drivers or operators, once the app searched for an operator it will show the real-time location of the vehicle which will pick up the passenger, after picking up the passenger the operator will then be guided by the Waze application to the marked destination which was previously entered by the passenger through the mobile application, as soon as the passenger arrives in the desire location the passenger will be prompt whether they will be paying via e-wallet, Paymaya, or Gcash. This mode of payment is not only secure but also fast and efficient given that proper COVID-19 protocols are applied.

The COVID-19 pandemic boosted the use of online payment systems for transportation services in the Philippines. E-wallet operator PayMaya has partnered with transport authorities to enable digitizing of payments in mass transit, transport hubs, gas stations, and delivery services, among others, with cashless payment solutions. With this method transport providers should make use of and accept contactless payments to minimize the risk of spreading the COVID-19 virus. The cashless payment solutions could help empower all modes of transportation from small to large public transport vehicles ([ABS-CBN News, 2020](#)).

The published journal article by ([Sunio, Gaspay, Guillen, & Mariano, 2019, pp. 2-3](#)) shows that "The PUVMP (public utility vehicle modernization program) is one of the projects of the administration President Duterte. Its objective is more than simple vehicle modernization, but a holistic system approach and reform by transforming the dominant transport regime in the Philippines. PUVMP, therefore, involves not only the introduction of road-based modern vehicles (e.g. buses, jeepneys, and AUVs) but the revamping well of practices, policies, business models, cultural meanings, and so on. PUVMP is expected to put an orderly and modern system of public transport provision, operations, and management. By making public transport perceived as superior to using a private car or motorcycle,

PUVMP aims to encourage car owners to abandon using private vehicles for their daily journeys and instead walk, bike, or use public transport.

According to the Philippine News Agency (Philippine News Agency, 2020), the Department of Transportation is preparing an opportunity to modernize the transportation system. The system includes projects, policies, and measures that will be undertaken for the new normal such as the automatic fare collection systems in public transport, e-toll collection technology. It's all technology-driven, integrated, and provides sustainable initiatives that not only address disease transmission but also revolutionize road transport to become efficient, reliable, environment-friendly, and safe.

In view of the mandated PUV modernization that calls for an automatic fare collection system in public transport and in consideration of the so-called post-pandemic new normal with heightened consciousness on the need to minimize contact and to avoid the exchange of items including monies during payment transactions before and during transit using PUVs, it will be of huge interest to determine the major implementation requirements for a multi-carrier contactless payment system throughout Metro Manila considering the variety of PUVs availed by the riding public and the idiosyncrasies of PUV ownership, operation and payment transactions.

3. METHODOLOGY

The primary aim of the study is to do a PUV system review with a focus on the payment transactions considering different PUV types, ownership, rider preferences, and payment habits, with the end in view of determining the implementation requirements of a contactless payment system for a multi-PUV ridership geared towards PUV modernization and new normal in a Post-COVID era.

The input-process-output approach will be adopted in meeting the research objectives, hence the following tabulated summary of the data requirements, analysis steps, and desired output will be the guide in the conduct of the study.

Table 1: IPO Table

OBJECTIVES	INPUT	PROCESS	OUTPUT
To profile the different PUVs and its users, owners and payment system	Payment habits	Observation Literature Review	Tabulated summary of payment system characteristics by PUV type
To assess the payment system areas requiring cash transactions where a contactless payment system can be implemented	Payment Process Flow	Walk-Through Interview / FGDs Process Analysis	Complexities; Streamlined System Requirements; Bottlenecks; Areas of Improvement
To recommend a suitable contactless payment system platform that will streamline the complexities associated with the use of multi-PUV commuting system in Metro Manila	Different Schemes of CPS; Results of the Survey on Commuting Public Payment Preferences	Force Field Analysis; <i>(weights will be determined by the results of the survey)</i>	Implementation Platform; Requirements of the most suitable contactless payment scheme
To develop alternative contactless payment schemes considering the peculiarities of PUV ownership and operation and the different ride preferences and paying habits of the commuting public	Streamlined payment systems per PUV type; Survey of Commuting Public	Conceptualization Requirements Planning Systems Design	Alternative Schemes of CPS; Evaluated CPS Scheme Viability

4. RESULTS AND DISCUSSION

Table 2: Summary of Payment System Per PUV

PUV Type	Type of Passengers	Age (by years old)	No. of Operators (per PUV)	Type of Payment	Fare in Php (varies in distance traveled)	Discounted Fare in Php (varies in distance traveled)
Jeepney	Teenagers, Working People, and Elders	15 to 60 and above	1	Direct Cash Fare	9 to 78	6.20 to 61.50
FX	Teenagers, Working People, and Elders	18 to 60 and above	1	Direct Cash Fare	6 to 77	20% of Fare
Taxi	Teenagers, Working People, and Elders	18 to 60 and above	1	Metered Fare + 40 (Tariff)	40 to 762	No Discount
Bus	Teenagers, Working People, and Elders	15 to 60 and above	1	Ticket-Based Fare	11 to 112.75 (Ordinary) 13 to 134 (Aircon)	8.75 to 90.75 (Ordinary) 10.50 to 107.25 (Aircon)

The table above shows the profile characteristics of each PUV and its respective payment systems. As you can see, taxis may have the highest fare among the 3 other PUVs while Jeepneys are the cheapest. Each payments system differs from the direct cash fare system, metered fare system, and ticket fare system. Buses have two different kinds one is ordinary (commonly seen on the road) and the other is air-conditioned (mostly seen in bus terminals). Jeepneys and FX differ in terms of fare and total distance 1 of each can travel to. In Metro Manila, we can conclude that the most used PUV is the Jeepney which is also called The King of the Streets. Overall, the output of the objective seen on the tabulated summary is that all of the transaction rendered per PUVs is all cash-based system

Table 3: Multi-Carrier Payment System (Survey and Results with a total of 311 respondents)

Questions	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Undecided</i>	<i>Agree</i>	<i>Strongly Agree</i>
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Do you agree, that a contactless payment across different PUVs will be of great help when commuting daily? (during the pandemic)	65	53	62	91	40
Do you agree, that if our Public Utility Vehicle (PUVs) are equipped with the contactless mode of payment via mobile application. It would make the transaction easy, quick, and safe?	54	52	55	112	38
Do you agree, if you will be able to reload your digital PUV card through 7/Eleven or by Bank Transfer with PayMaya and GCash?	55	46	52	113	45
Do you agree, that a contactless payment system for PUVs will be much more reliable, secure, and efficient than the current payment system than what we have at present?	55	39	65	110	42
Do you agree, that you will be able to use this type of payment method often in the time of the pandemic and after?	53	37	62	108	51
Do you agree, that the contactless payment system is available on all PUVs may it be owned by a company or by a sole owner. As long as they do not violate the terms and conditions given by the Land Transportation Office (LTO)?	55	38	66	112	40
Do you agree, that if the contactless payment system allows you to use it with multiple PUVs one after the other? (Ex. Taxi-Bus-Jeepney)	47	45	64	111	44
Do you agree, that having the contactless payment system in PUVs will help decrease the spread of the COVID-19 virus for the commuting public?	53	43	64	105	46
Do you agree, that in the creation of this type of contactless payment system in PUVs? People, who are less likely to have the medium or requirements in using this type of service have the option to pay the operator of the PUV by placing their payment in a small basket before boarding the PUV?	57	38	62	115	39
Do you agree, that the commuting public will be able to adapt to the Multi-Carrier payment system even after the pandemic?	58	45	57	111	40
Do you agree in using the Multi-Carrier payment system on PUVs during and after the pandemic?	65	32	62	100	52

The table above shows that 131 of the respondents agreed to the multi-carrier payment system approach while 128 disagreed and 62 have not decided. The data shows that there's almost a 50-50 percent of hesitancy to adapt however on this approach the researchers will take the risk and take it as an opportunity to push for a contactless, and money-less transaction within the PUVs. Despite as well having hesitancy, there are still multiple upsides to take the survey to the favor of a contactless and money free payment system, that will be seen on the force field analysis.

Scan-to-Pay Method

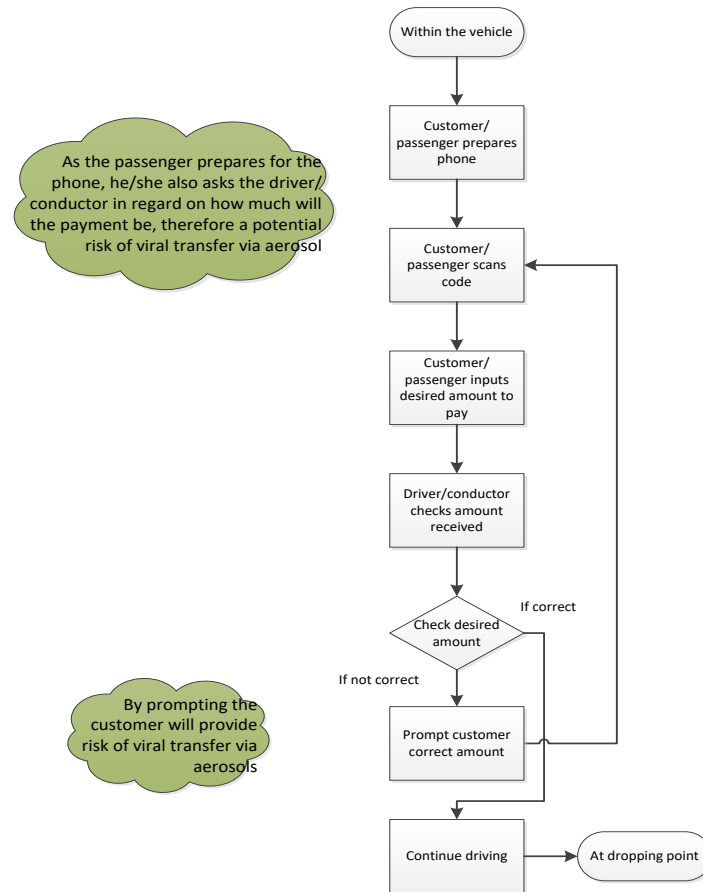


Figure 1. Scan-to-Pay Method Flowchart Storm Clouds

As you can see on the “scan-to-pay” method, there’s still a form of a potential transfer of virus, and that is through word of mouth that may cause the virus to be airborne. Reducing the risk will be further discussed as the researcher will choose one of the methods moving forward.

The other method that is “Tap-in/Tap-out” method also shares the same risk but different form of failure as shown:

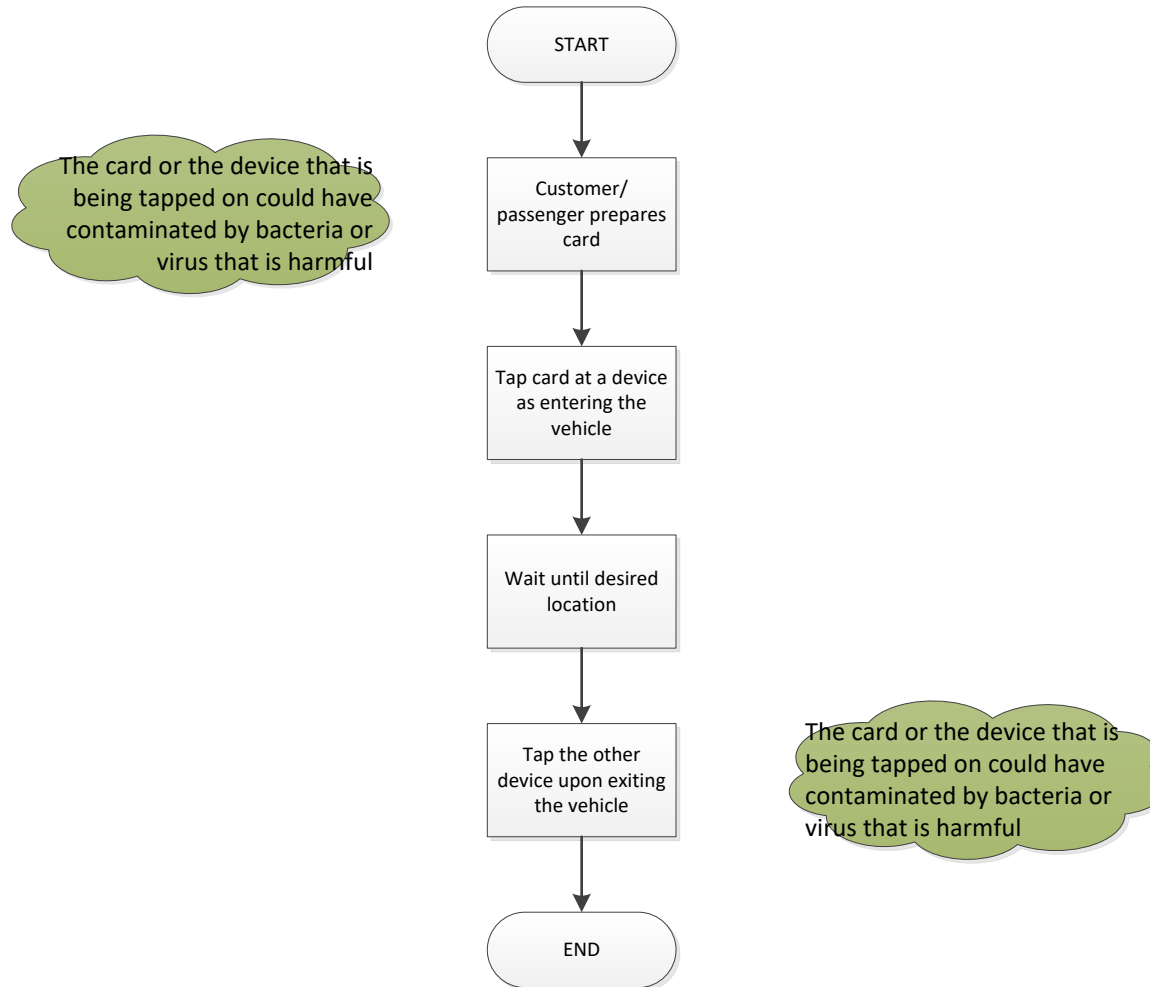


Figure 2. Tap-in / Tap-out Method Flowchart Storm Clouds

As seen on the “Tap-in/Tap-out” method, the failure point is the transmission of the virus via card and the device being tapped on. Hence a new risk on a new way of doing a cashless transaction

Creating new ways or solutions also creates new risks, the researcher’s goal is to create a solution by reducing these risks. These solutions to reduce the risk will be further discussed moving forward.

New forms of methods alter the traditional payment system that is cash-based, hence creating new processes such as the check and balance and the way how money is being tracked from the driver to the customer, vis-à-vis. The upside to this is creating a less viral transfer to both parties as such lessen the fomite transmission.

Doing such a system, among the two methods the researchers opt to stick to the "scan-to-pay" method. Having so, the researcher creates potential scenarios, step by step process, and new ways on how will it proceed with the uses of wireframes and service blueprint to see the big or whole picture from the transaction is being transferred, loading the device, payments and receiving the amount on the end-users. Doing the Multi-Carrier Payment System requires processes to which it should be feasible for users.

It all starts with the service blueprint. Which shows the overall structure on how payment is being held from the passenger and being transferred to the driver/conductor. Through a cashless transaction method.

Service Blue Print

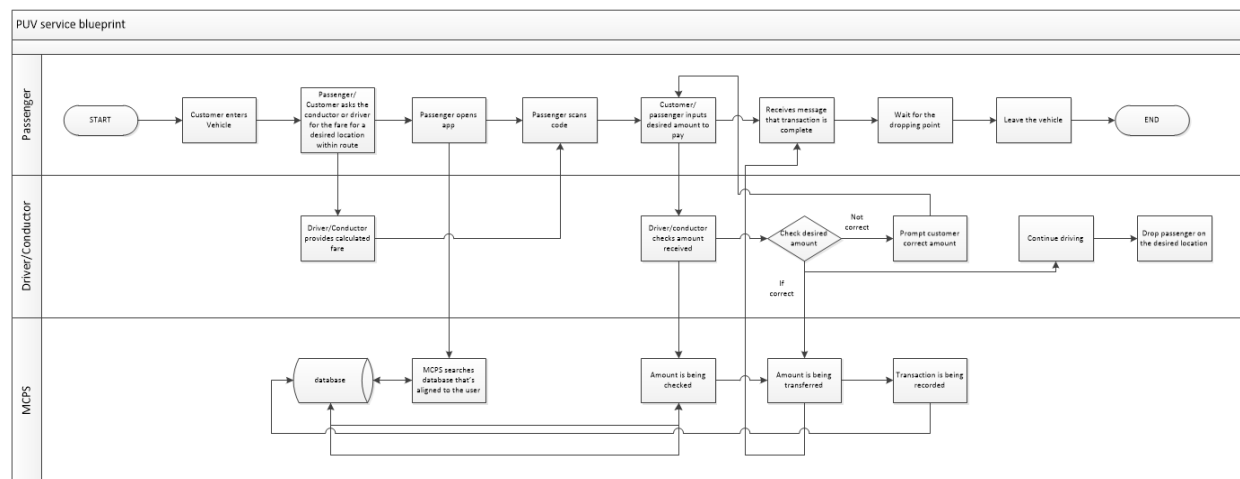


Figure 3. Service Blue Print

Seen above shows the process to which a basic transaction is being made within the PUV. It has also shown a basic system by which a check and balance is being made with the driver and the app itself. Doing so provides us no money has been transacted but via online instead.

Having this blueprint comes with risks and failure points where it will be seen in the next figure.

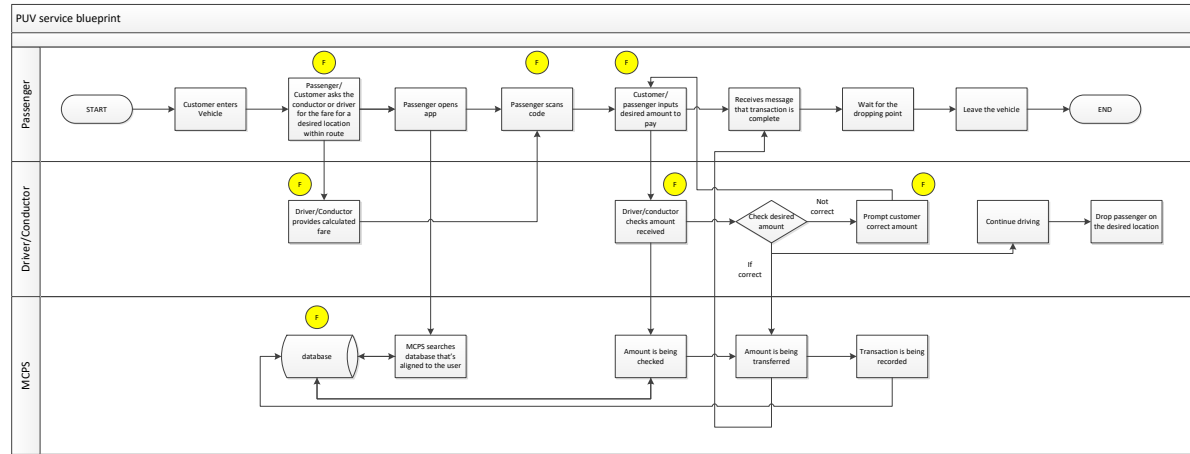


Figure 4. Service Blue Print Risks and Failure Points

To have a better view, these are the failure points on the process blueprint:

- Passenger/Customer asks the conductor or driver for the fare for the desired location within the route
- Passenger scans code
- Passenger inputs desired amount to pay
- Driver/conductor provides calculated fare
- Driver/conductor checks amount received
- Prompt customer correct amount
- Database

Table 4: FMEA Table

Process Step	Potential Failure Mode (input failure)	Potential Failure Effect (output failure)	Potential Cause	Current Process Control	S E V	O C C	D E T	R P N	ACTION RECOMMENDED
Passenger/Customer asks the conductor or driver for the fare for a desired location within route	Does not wear proper PPE during transport	Unable let the passenger continue riding the PUV	Passenger does not know basic Safety Protocols	Provide notification placards upon within the vehicle	2	3	1	6	Proper notification towards passengers to wear the PPES properly

Passenger scans code	Unable to scan code for payment	Unable to pay in a cashless transaction	The QR code is not clear	Printout clear QR placards	2	1	1	2	
Passenger inputs desired amount to pay	Inputs a wrong amount in regards to payment	Wrong amount received by the driver/conductor	Intentionally inputs wrong amount	Driver/Conductor reassess payment provided by the passenger	2	2	1	4	Driver/conductor should properly reassess the amount
			Mistakenly inputs the amount	Driver/Conductor reassess payment provided by the passenger	2	2	1	4	Driver/conductor should properly reassess the amount
Driver/conductor provides calculated fare	Provides wrong calculations in regards to fare	Receiving wrong amount by the driver/conductor	Metric fare table was not reviewed by the driver/conductor	Driver/Conductor reviews metric fare table	1	1	1	1	
Driver/conductor checks amount received	Amount seen does not match on actual calculated metric fare table	Loss of income of the driver/conductor	Does not check the amount properly	The app will prompt the driver/conductor to proceed if amount is correct	2	1	1	2	
Prompt customer correct amount	Does not address the correct amount towards the passenger	Loss of income of the driver/conductor	Does not check the amount properly	The app will prompt the driver/conductor to proceed if amount is correct	1	2	1	2	
Database	Server down	Unable to use the app	Technical issues on the main server	Provide alternative or backup servers to make the system ongoing	2	2	1	4	System's database or server must be properly secured for smooth transactions

These failure points are the processes where there could be some possible errors where the system might fail and does not work therefore a solution must be created through the use of Failure Modes and Effects Analysis (FMEA).

With the use of the current technology like the internet it provides us ease of use especially when mobile banking is available and does provide similar ways to create cashless methods. By integrating this method on the multi-carrier payment system within the PUVs a system that lessen transmission due to the pandemic and will the future of contactless payment while using public transport.

5. CONCLUSION

In conclusion, the results on our objective show that there's an area of improvement with the effort of creating a contactless payment as shown on the service blueprint. With this approach, the application of the multi-carrier payment system in the new normal will significantly decrease the risk of the commuting public being infected by the covid-19 virus. As the researchers conducted surveys, it provides us a clear view that some people are willing to take the said app. With this type of payment system, passengers will have peace of mind when it comes to safety. The use of a contactless payment system via the mobile platform to book or have a ride will give more convenience to the commuting public especially in metro manila PUVs. The fast, ease, and reliability of transactions between the operator of PUVs and passengers will be flawless and worry-free this is also to be protected by each party on the uprising of the virus. This is also the next step to be the new normal on our local PUV system as we uncover new ways in the contactless payment system.

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Biographies

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Fritz Gerard B. Hernandez is a graduating student of Bachelor of Science in Engineering Management in Mapúa University. Was a student member of Mapúa Engineering Management Organization (MEMO), Philippine Institute of Industrial Engineers (PIIE) and Mathematical Society of Mapúa (MSM). His expertise is providing good schematics for processes and good decision making, service value management, and tackling problems. His goals in life are to help people, and to provide good management decisions. He takes interests in services, processes and basic challenges by making life a bit easier. Achievements done is creating proper frameworks and using tools that are beneficial to the processes in hand. An avid gamer, fond of cooking and does have some ideas in regards to pcs and its peripherals.

Marvin I. Noroña is a faculty member at the Mapua University School of Industrial Engineering & Engineering Management and School of Graduate Studies. He earned his BSIE and MBA degrees from University of the Philippines and is completing his dissertation for a Doctor in Business Administration degree at the De La Salle University. Apart from research and teaching, he is into management consulting and training in the areas of sustainability, supply & operations management, production & service systems improvement, strategic planning and management, lean six sigma, and design thinking.