

# **An Android-Based Jeepney Payment System in Angeles City Using Quick Response Code**

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*Transportation is the heart of any place in Philippines. Without transportation, people will not be able to travel long distances or go to their destinations. It is one of the most important things for people who are in school, work, or any activities that involvemoving from one place to another. "Bayanihan" is a mode of payment in jeepneys where passengers pass their money from passenger to passenger until the driver receives it and gives back a change from passenger to passenger again. Today, there are already electric modes of payments implemented in some transportation systems such as the Light Rail Transit and Metro Rail Transit which use Beep cards. Electric mode of payment is implemented not just in transportation but also in the market such as grocery stores, malls, etc. A Quick Response code, also known as QR code, is a module displayed in black patterns and white background. A QR code can be used to redirect URLs, and promote business especially in transactions. This paper mainly presents the benefits of integrating QR code as an electric mode of payment which can be implemented in jeepneys using Android mobile phones to make transactions faster and efficient. This application will help make transactions in jeepney implement an electronic method of payment while it can still be implemented in old and modern jeepneys.*

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*Keywords: jeepney, payment, QR Code*

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## **Introduction**

Transportation is often said as the lifeblood of cities. People and goods and raw materials rely on transportation. Transportation also bridges remote places and helps humans in their everyday work and travel; therefore, it is considered as a basic need in the Philippine economy (Cendana & Desiree, 2018). Public modes of transportation are made because they are more economical and energy efficient. Public transportations also provide service for all people who do not own a private vehicle (Vuchic, n.d.) Without public transportation, lots of operations will halt and people will not be able to go to their destinations.

In the Philippines, Public Utility Jeepney (PUJ) is a well-known mode of transportation that shows the creativity of the Filipino people. Jeepneys serve as the main mode of public transportation that provides an easily accessible and cheap service to the commuters. Two hundred fifty thousand (250,000) jeepneys are currently operating in the Philippines with their quarter operating just in Metro Manila (Clean Air Asia, 2017). Public Utility Vehicles (PUV) are commonly used for long distance journey. Usually, passengers do not have the exact amount in paying jeepney fares and the method of passing the payment and change is time-consuming and inefficient (Belda et al., 2015).

A QR code is a certain barcode that can be detected by using an exclusive QR code reader, or by using a phone with a high-resolution camera. The QR code is made up of black modules displayed in a square pattern on a white background (Surekha, et al., 2015). People

use a QR code by scanning it using their mobile phones to acquire the information encoded in it. (Lin, et al., 2015). A QR code can be adapted to almost everything and anything (estateqr.com, 2013). According to Kaynak and Deymir (2015) quick response codes are starting to be a part of our everyday life. QR codes are being used for different purposes; some are for mobile banking or transactions, direct contact to customers, customer feedback, and other areas where quick response codes can be applied (Demir, Kaynak, & Demir, 2015). Integrating smartphone and mobile ticketing systems is being implemented in public transportations and is becoming a trend now. Technologies such as QR codes and Near-field Communication (NFC) can be used (Couto, et al., 2015). But why use QR code? Using QR code is cheaper than using technologies such as NFC and point-of-sale (POS) terminals (TheNerve, 2019).

Under the PUJ modernization program of the transportation department, automated fare-collection system should be implemented in every public utility jeepney. Modern jeepney prototypes on display at an event were enhanced with beep card readers that will let the user to tap in and tap out. Passengers will tap in upon entering the PUJ and tap out before alighting. Fare is calculated depending on the distance traveled. This is the first ever automated fare-collection made for jeepneys. The use of an electronic payment system will promote the Anti-Distracted Driving Act which was enforced in 2017 (Tadeo, 2017). The transportation department is planning to modernize the public transportation sector in the Philippines. It also involves the phasing out of the old style jeepneys (Marasigan, n.d.).

Problems arise in payments. These include passengers not paying the right amount of fare covered by the distance they travelled, giving change can distract the drivers that can lead to inaccuracy of change, and discounts for persons with disabilities, students and senior citizens are sometimes not recognized by jeepney drivers.

By implementing a jeepney payment system using Quick Response code, transactions will be faster and efficient. The study is helpful in implementing technological changes in the local transportation system while supporting both the modern and old jeepneys.

## Method

The conceptual framework is shown in Figure 1.

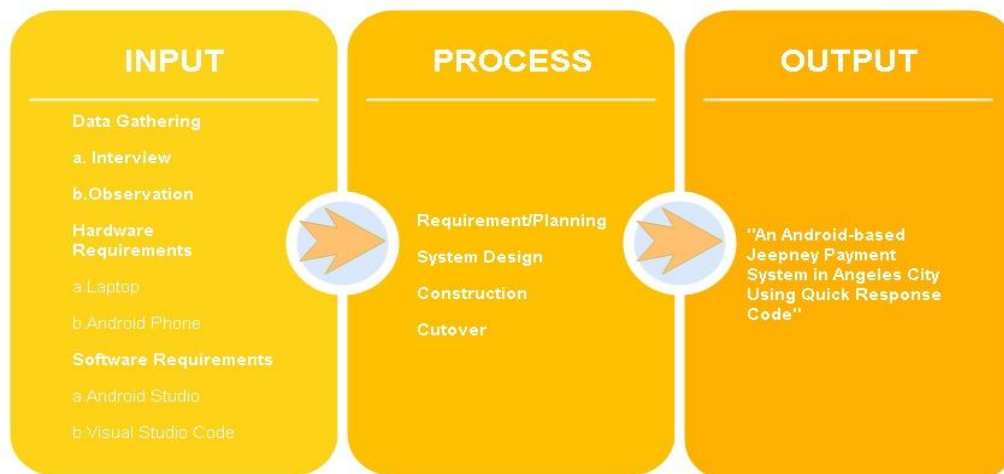
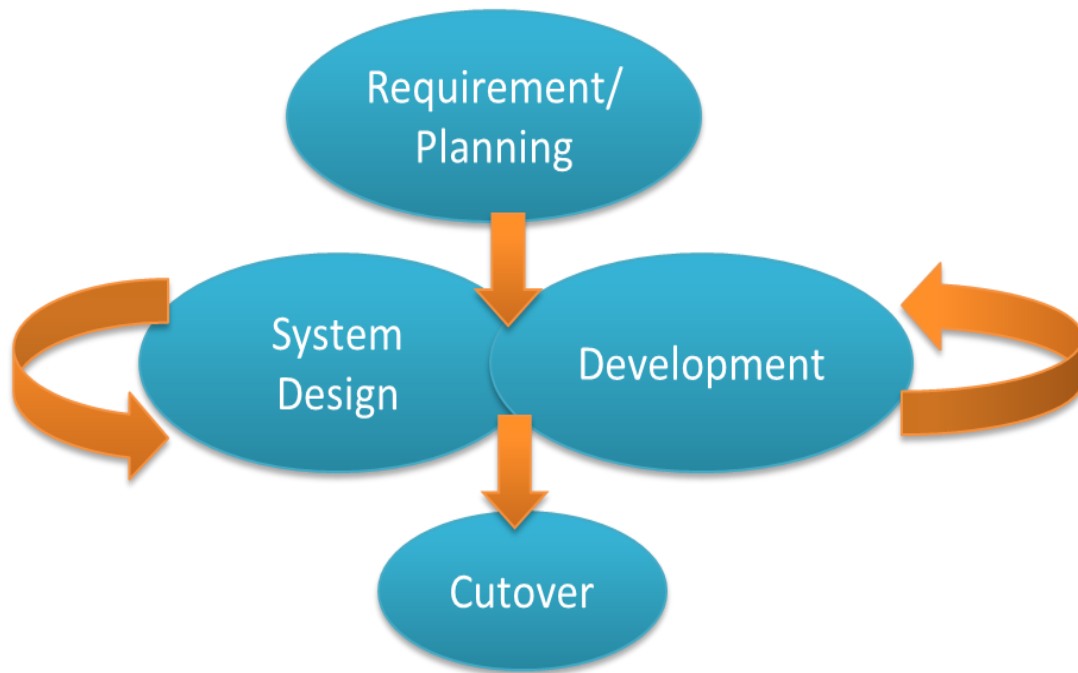


Figure 1. Conceptual Framework of the Study

The conceptual framework was designed based on the perception of the researchers on how the study or research would be developed. The diagram shows the steps required in order to produce the expected output. The conceptual framework is divided into three parts, the input, process, and output. The input consists of the variables that are needed in developing the application like the hardware and software specifications. The process is where the methodology is indicated. The output is the study or research itself.

The system development methodology is shown in Figure 2.



*Figure 2. System Development Methodology*

The phases are requirements planning phase, system design phase, development phase and cutover phase. There is a continuous interaction between the system design phase and construction phase.

1. Requirements Planning Phase – In this phase, the researchers conducted research, agreed and planned on how to develop the said application to solve the problem on jeepney payment system, and to determine what would be the outcome of the system. This is the initial stage wherein the researchers set a goal to have a clear understanding of the research project which is the “an Android-based jeepney payment system using Quick Response code”.
2. System Design Phase – In this stage the interface, modules and data of the system are created. Before the actual development of the system, the developers had to prepare and create the modules and interface that were used in the actual developing of the system.
3. Development Phase – This is the stage where the researchers developed the program and application, coding, unit integration and system testing. This is where the actual coding of the developers began while testing every code that could be tested and what could be integrated in the system for further implementation.

4. Cutover Phase – In this final stage the application was already finished and was ready for testing. This is also where the user training happened. In this phase, the clients and the developers continuously looked for bugs in the system.

The use case diagram is shown in Figure 3.

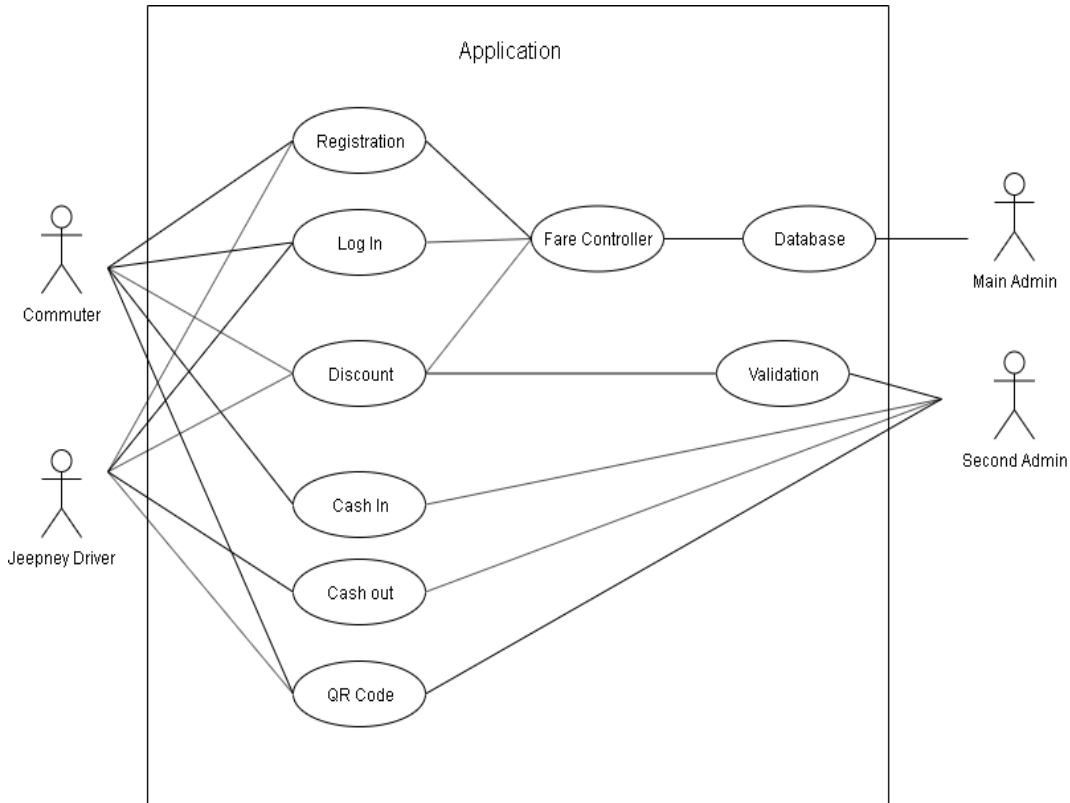
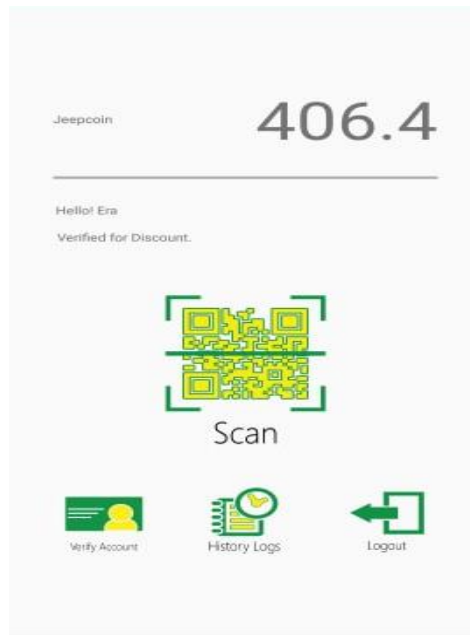


Figure 3. Use Case Diagram

The Use Case diagram describes the assets of actions that the system performs. There are four actors in the diagram, the Commuter, the Jeepney Driver, the Main Admin and the Secondary Admin. The Commuter can access Registration, Log In, Discount and Cash In. The Commuter needs first to register before he can access the application. Like the Commuter, the Jeepney Driver can also access to Registration, Log In, Discount, Cash out and QR Code. The Jeepney Driver will register an account in the application as a driver. His registration will be sent to the Admin. Once the registration is successful, he will be directed to the Menu Interface to view the collected tokens. The Jeepney Driver also provides the QR code for the passenger to scan for payment. The Main Admin is the one who has the access to the database and is responsible for managing data when updating the database. The Secondary Admin is the one who validates the discounts and receives the information entered by the users.

## Results

The User Interface (see Figures 4-6) shows the different views that can be seen in the application.



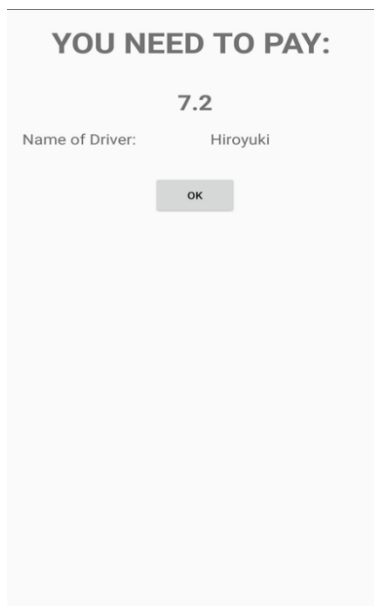
*Figure 4. Main Menu*

The main menu has the (1) Jeepcoin, which is the amount of money the users have, (2) scan which needs to be directed to the camera of smartphone to scan the QR code, (3) history logs to see the previous transactions, and (4) logout.



*Figure 5. Camera to scan QR Code*

Figure 5 shows the camera of smartphone that scans the QR code.



*Figure 6. Transaction Display*

Figure 6 shows the transaction amount of the fare for jeepney after scanning the QR code.

This part of the study presents the complete result of the evaluation conducted by the users and IT experts. The evaluation criteria were based on the characteristics or metrics of ISO-25000 or the Software Quality Assurance. The participants for the evaluation consisted of fifty (50) users: 10 Students, 10 PWDs, 10 Senior Citizens, 10 Regular Commuters and 10 Jeepney Drivers in Angeles City and three (3) IT experts.

*Table 1. Assessment of Users*

<b>Indicators</b>	<b>Mean</b>	<b>Description</b>
Functional Suitability	3.89	Very Good
Performance Suitability	3.78	Very Good
Compatibility	3.68	Very Good
Usability	3.78	Very Good
Reliability	3.93	Very Good
Security	3.85	Very Good
Maintainability	3.70	Very Good
Portability	3.95	Very Good
Total	3.82	Very Good

Table 1 shows the result of the evaluation from the users. The overall rating given to the application has the mean of 3.82 which is equivalent to a “very good” rating. This shows that the application met the users’ requirements.

Table 2. Assessment of IT Experts

Criteria	Mean	Descriptive Rating
Functionality	4.33	Excellent
Performance efficiency	4.00	Very good
Compatibility	4.50	Excellent
Usability	4.22	Excellent
Reliability	4.25	Excellent
Maintainability	4.20	Excellent
Portability	4.40	Excellent
Overall	4.29	Excellent

Table 2 shows the result of the evaluation of IT Experts. The overall rating given to the application is 4.29, that is, “excellent.”

## Discussion

Based on the computed results of the evaluation from the three (3) IT expert and fifty (50) users, it was tested and proven that the system is applicable for commuters but jeepney drivers disagree because they do not want modernization for the jeepneys. The total mean for IT experts was excellent. Compatibility ranked the highest among the IT experts and portability ranked first among the commuters while usability, reliability and maintainability ranked the highest among jeepney drivers. However, there are still features in the application that need to be improved in the terms of compatibility. The researchers also considered the comments and suggestions of the participants for further development of the application. With this, the researchers were able to develop a system encompassing function suitability, performance efficiency, usability, reliability, and compatibility.

## Conclusion

Based on the results, the following conclusions are drawn:

1. The researchers successfully developed an application that enables users to pay jeepney fare using QR code.
2. The researchers successfully created an application that takes advantage of the QR code technology and use it into more functional use.
3. The researchers successfully provided its user a more reliable fare computations that are also suitable for persons with disabilities, students and senior citizens.

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