

DEVELOPMENT OF WEB APPLICATION BASED ON CROWDSOURCING FOR CAR RENTAL MANAGEMENT BY USING SCRUM METHODOLOGY (CUSTOMER SIDE)

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Abstract—Too much information about various car rental services provider is spreading out on the Internet within many different websites. This matter makes almost half of the people find difficulty to get the car rental information directly, because they will hardly filter information one by one according to their needs with the limited time they have. Therefore, they rely more on information that comes from mouth to mouth or suggestions from nearest people. The research aims to develop a web application based on crowdsourcing for car rental management focused on customer side specifically in order to store the rented cars information from various rentals become centralized. Then, by this application, renters do not need to open each of the car rental websites when they want to rent multiple cars. For application development, it will use Scrum methodology made in six sprints by involving analysis, designing, coding, and integration. Web application itself is built by using concept of Model-View-Controller (MVC) which utilizes PHP programming language within Laravel framework and MySQL database. The result of research is crowdsourcing-based website application to help customers not only be easy to search rented cars, but also easy to book multiple cars from various rentals until confirm their payment. Moreover, they can share information electronically through social media faster than mouth to mouth. The research application is additionally able to help many rentals for promoting their cars and increase the satisfactory services to renters.

Index Terms—Car Rental Management, Web Application, Crowdsourcing, Scrum

I. INTRODUCTION

A car is one of the tertiary needs that keeps on supporting people's daily activities such as traveling from one place to another. Generally, people travel not only in the city, but also between cities. According to the survey from Nielsen Global Survey of Automotive Demand, Indonesia's population who do not own car reaches 42% in 2013 [1]. Therefore, the number of residents with that total percentage is estimated to be difficult to do some traveling between cities because they do not own any private car. In addition, based on survey result that have been obtained from 90 respondents of the certain residents in the span of a month from October to December 2014, it proves that the

high number of respondents feels difficulty when traveling out of the city by using public transportation. Thus, this condition will allow most people to use car rental services to travel out of the city.

Car rental service provider may become one of the important things for traveller. That statement is supported by the previous survey result showing 54 of the 90 respondents always rent a car in a span of three months with a minimum of one until two times. The rented car itself is usually used for personal or corporate purposes, such as tourism, business travel, and some kind like that. The intensity of routinely renting car may indicate the car rental providers have a good prospect for its growth. Nonetheless, it still needs to be supported by spreading its information appropriately.

Based on the result of still same survey, the delivery of information for car rental services is relatively not good. Currently almost half of the people find difficulty to get the car rental information directly in accordance with their needs, so they rely more on information that comes from mouth to mouth or suggestions from nearest people, as shown in the chart result of Figure 1. Meanwhile, the search of car rental information through internet is only done by the small number of residents. It can be caused by too much information about various car rental services provider spreading out on the internet within many different websites, so the renter candidates will hardly filter information one by one according to their needs with the limited time they have.

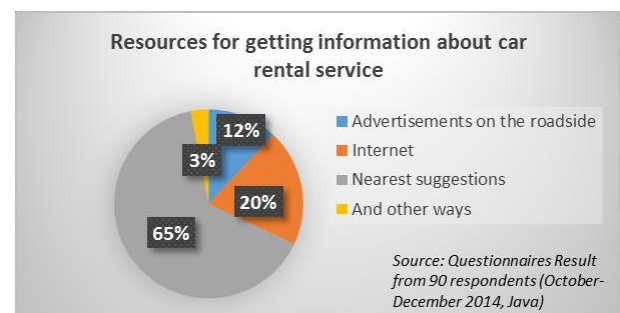


Figure 1 Percentage of Various Resources Respondents Use for Getting Car Rental Information

At the present time, crowdsourcing can be used as a

method of collecting product information becoming in focus and centralized from various agencies or companies. Related to the car rental object, this method can be used to gather car rental information from various agencies or companies of car rental service into one website application and then the renter candidates can filter the information according to their needs effectively and efficiently. In Indonesia, the website application based on crowdsourcing has been implemented to several concern objects, such as www.sribu.com focusing on design services, www.jobstreet.com focusing on job information, or www.lazada.com for buying and selling of goods. The market share of those three objects is fairly good because they can adapt and meet the customers' needs specifically.

On the other hand, those crowdsourcing-based websites can implement e-commerce or online shopping that allows customer to not transact by directly face to face with the seller. The market share of e-commerce in Indonesia itself has a fairly rapid growth. In 2014, the number of Internet users is projected reaching 107 million people and becoming 139 million people in the next year [2]. It enables to become the growing market potential of e-commerce for many years into the future. This growth is supported by data from the Ministry of Communications and Information Technology, which states that the value of e-commerce transactions in 2013 reached Rp 130 trillion [3]. It indicates that the transaction for online purchases is increasingly in demand by consumers in Indonesia. Therefore, the e-commerce implementation on the website application based on crowdsourcing for car rentals can ease the renters to do the payment transactions, after they have completed their bookings addressed to various car rental providers.

At this time, there have been several crowdsourcing-based website applications that provide information for the category of car rental services from various agencies or companies, such as www.olx.co.id/jasa-lowongan-kerja/jasa/rental-mobil-motor and www.tiket.com/sewa-mobil. Besides that, this type of application has also been developed in previous researches, namely *Getrent* and *E-Vehicle*. Those four applications will become benchmark for this research application development that is built in form of website based on crowdsourcing for car rental management. It is specifically focused on customer side. The aim of this research is covering the deficiencies contained in the existing applications, so it can provide the satisfactory services to customers when renting a car.

II. CAR RENTAL MANAGEMENT SYSTEM, CROWDSOURCING, AND WEB APPLICATION DEVELOPMENT

Car rental management system can be used to manage car rental, which is then expected to accelerate archiving the data of services better and safer to customers, so it is able to ease the car rental service providers for getting those data at any time. It can be implemented by online to support customers to do the booking process, to help the

management side in knowing the availability of rented cars at any certain time, as well as to process transactions between branches of car rental or support the process of transactions for renting the transport itself by the customer [4]. Generally, some existing car rental online systems itself show that the website for renting cars will feature the booking form to reserve the rented cars, the cancellation fill form to cancel the booking, the rented cars catalogue, and the feedback form to fill in review [5].

Initially, car rental management system stands alone in each of the car rentals and its information exists only on their directory respectively, but nowadays its information can be centralized on a website application based on crowdsourcing. According to Estellés-Arolas and González-Ladrón-de-Guevara, crowdsourcing itself is a kind of online activities that involve the participation of a group of individuals with a wide range of knowledge and diversity (heterogeneity) respectively, in which this activity is in the form of work assignments offered by individuals, institutions, non-profit organizations, or companies through an open call flexible (voluntary). The execution of these tasks always provide benefits to both parties, either those who offer or those who are working on [6]. In the crowdsourcing, the internet has a role to connect people around the world through various channels and different technologies, so that the information and ideas that they have can be traded through this channel. According to Grier, crowdsourcing requires four different elements, namely the individual or institution, usually called crowdsourcer, which manages the main processes or offers work tasks; a group of people, usually called the crowd, who perform work tasks or contribute in sharing information they have; market of its own, usually called crowdmarket, which is used to help for managing the contributions made by crowd—often found on Internet sites called crowdsites or platforms; and how to communicate with the crowd which usually use the internet [7]. In the case of car rental management based on crowdsourcing, crowdsourcer can be called as renter candidates, crowd as car rental, and crowdmarket or crowdsites as online application system for car rental management. Finally how to communicate with the crowd will be handled in form website development.

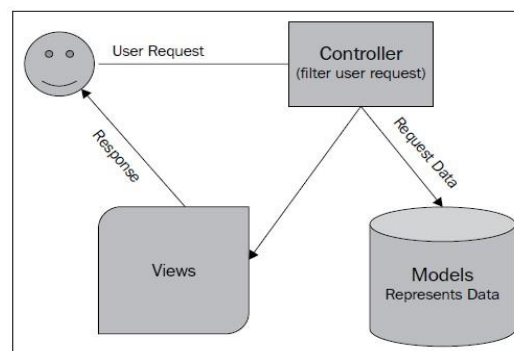


Figure 2 Working Way of Model-View-Controller (MVC) [9]

Website or web application itself can be built by using concept of Model-View-Controller (MVC), as shown in Figure 2. According to McArthur MVC is a design pattern that simplifies the development and maintenance of applications. This pattern separates an application into three components, namely model, view, and controller [8]. The structured working way of MVC can really make a separate view for single models, namely like when creating an e-commerce site which pays more attention to the product page. That site may have some view like for product list or product gallery [9]. Absolutely, this pattern is suitable for developing most web application.

III. RESEARCH METHODOLOGY

This research uses software development methodology, which is called Scrum methodology. Based on literature studies that have been done by Hossain, Babar, and Paik, Scrum itself is a project management approach is iterative and incremental that provides a framework that can check and adjust easily [10]. Meanwhile, Rubin states that Scrum is an Agile approach to develop innovative products and services [11]. The activities of Scrum are step of product backlog, sprint planning, sprint backlog, sprint execution in which it has the daily scrum, building products partially, sprint review, and sprint retrospective as shown in Figure 3.

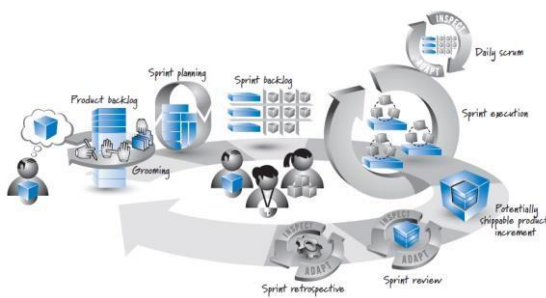


Figure 3 Scrum Activities [11]

Before doing Scrum methodology in software development phase, problem and solution identification phase must be done initially. At this phase, the problem identification is done by collecting data and questionnaire as supporting the problem definition. Then, finding solution to solve the related problem will be based on the literature study conducted. The next step will deal with planning of product features for this research application that involves the process of benchmarking and reviewing other related applications along with those features.

After that, software development phase will be done by involving Scrum. In this phase, each features that is developed will be grouped into step called the sprint. Then, there may be more than one feature in each sprint in which it usually needs two until four weeks for development. This research will actually run into six sprints and the allotted time for each sprint is determined during two weeks. Then in the early development, the initial planning will be built in the form of product roadmap. This roadmap will

represent the development schedules and targets that have to be achieved within a certain time. After that, product backlog will be made to describe user stories related this application research. For further processing, each sprint will run by involving analysis, designing, coding, integration, testing, and review gradually.

Lastly, after the application final result of this research has fulfilled the defined requirements, some conclusions and suggestions can be made for any subsequent related application development.

IV. SYSTEM ANALYSIS AND DESIGN

The web application of this research is developed for car rental management based on crowdsourcing, called Nyewamobil.com. It will be absolutely focused more on customer side in which becoming front-end to interact directly with renter candidates. Nyewamobil.com is built surely after doing some previous observations. With this application, they can search information about availability, specification, price comparison, rating, and testimonial of the rented cars as well as rental partner profile through one website.

Nyewamobil.com can be also developed to avoid the deluge of car rental information on the internet in which circulating on many websites that is not centralized. Therefore, renter candidates can easily filter the information as needed on an individual basis with limited time owned by them. Nyewamobil.com will collect car rental information and make it centralized from various rental partners. This web application ultimately implement crowdsourcing method which has a main role to meet renter candidate and partner rental at each other through internet, as shown in Figure 4.

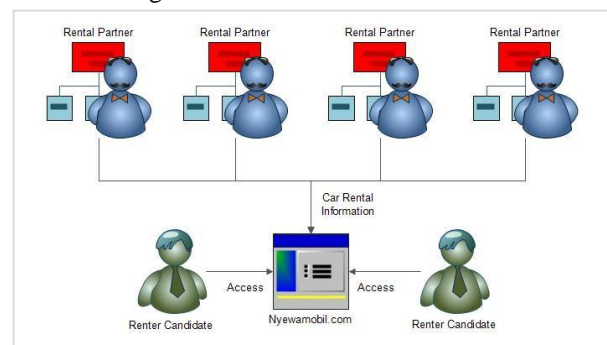


Figure 4 Crowdsourcing Implementation on Nyewamobil.com

A. Business Model Canvas

Nyewamobil.com is modelled in business model canvas which has nine parameters to be fulfilled, namely: key partners, key activities, key resources, value propositions, customer relationships, channels, customer segments, cost structure, and revenue streams. Its explanations are as follows:

- 1) *Key partners.* This application needs to cooperate with some car rentals for supplying their rented car information as well as its specification.

- 2) *Key activities.* This application will help in searching out information about availability, specification, price comparison, rating, and testimonial of the rented cars as well as rental partner profile; booking the selected rented car until doing payment confirmation; and sharing rented car information from various car rentals to the society.
- 3) *Key resources.* The main of Nyewamobil.com needs rented car information and specification from rental partners. Technically, this web application needs template, hosting, and domain as well as server to save all related database.
- 4) *Value propositions.* Nyewamobil.com will help renter candidates to easily filter the information as needed on an individual basis with limited time owned by them. Not only that, renter candidates can booking and doing payment confirmation by online.
- 5) *Customer relationships.* Nyewamobil.com has initially owned landing page, before launching surely, for getting customer's email and keeping in touch with them to ask feedback about this application later gradually.
- 6) *Customer segments.* This application requires only one actor; that is renter with age of 17 years old and over who has ID card or identity number and is preferably able to operate website through internet.
- 7) *Channels.* Renters can reach this application by themselves through internet channel by typing www.nyewamobil.com on web browser.
- 8) *Cost structure.* The most important costs inherent on Nyewamobil.com is more related to key resources in which this application needs template, hosting, and domain as well as server to save all related database. Meanwhile key activities will run freely on website, so its cost does not mean much.
- 9) *Revenue streams.* This application can get income from fee of each payment transaction that has been done by every renters. When doing payment, they can transfer the money to centralized bank account. So, before Nyewamobil.com transfer money to each rental partner bank account, it should be cut firstly as determined. Secondly, revenue can be taken from fee of web catalogue in which rental partners must show and promote their rented cars on Nyewamobil.com.

B. Functional Requirements

Nyewamobil.com itself has some functions that should be suitable to build web application for car rental management based on crowdsourcing focused on customer side specifically, namely:

- 1) *Searching the rented cars.* This feature is a main function used to find the availability of the rented cars from various rental partners based on city and date. After the view of that availability has appeared, customers can do sorting and selecting the rented cars based on price range. This becomes first core bridge to adjust the renter's needs with the rental partners.
- 2) *Booking the rented cars.* After doing searching, customers can book their addressed rented cars. They are able to choose multi-cars and amount for each cars. Then, they must complete booking form in order to do payment only by bank transfer.
- 3) *Doing payment confirmation.* This function can only be used well if customers have done in booking and paying their invoice. It is used to confirm payment, so administrator can change status become 'Confirmed'. Absolutely, after doing this, customers will know the detail of the rented car numbers they get.
- 4) *Member registration.* Customers are able to register for being a member, then get some special features that can only be accessed by member, such as profile management, viewing the transaction history, proposing car personally, as well as rating and review for cars and rentals.
- 5) *Profile management.* By this function, members can update their profile picture and personal details.
- 6) *Viewing the transaction history.* For booking made after login has succeed, members' transaction will be recorded to the transaction history. Thus, members can see the detail of their bookings as well as its status.
- 7) *Proposing car personally.* This will allow any customers who already become member to propose their cars for being rented by their target of rental partner through complete proposing car form. After doing proposing, they can also know whether their cars is accepted or not by their rental target. If status marks 'Accepted', members can also know what time their cars is rented by renters.
- 8) *Rating and review for cars and rentals.* This function is used to record members' feedback in form of rating and review. Rating for cars is made for each paid transaction. For rentals, members can do rating and review only addressed to the rental partner in which its car is ever booked by them.
- 9) *Viewing the cars catalogue.* This function will show the rented cars that exist on Nyewamobil.com. The cars will only be grouped by car name, so it looks more general.
- 10) *Viewing the rentals catalogue.* This function can be used to know the rentals who have formed a partnership with Nyewamobil.com. For members who want to propose their cars, it is able to become their reference for selecting their rental target.
- 11) *Sharing information by social media.* Any customers can share cars and rentals information through social media account. This function is used to promote car rental by customer itself electronically, so spreading information becomes more effective and efficient.

Those functions will interact with some classified customers. It is represented into the use case diagram, as shown in Figure 5.

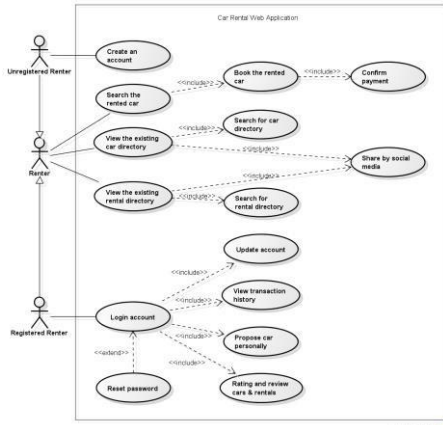


Figure 5 Use Case Diagram for Nyewamobil.com (Customer)

C. Core Business Processes

This research application is intended to change the conventional business process when customers want to rent a car. Therefore, business process related to the car booking process will be the core for Nyewamobil.com built in web application focused on customer side. Those core business processes cover from searching until booking the rented cars. The activity diagram, which is used to describe activity processes existing on application system, below will show the working way for those processes.

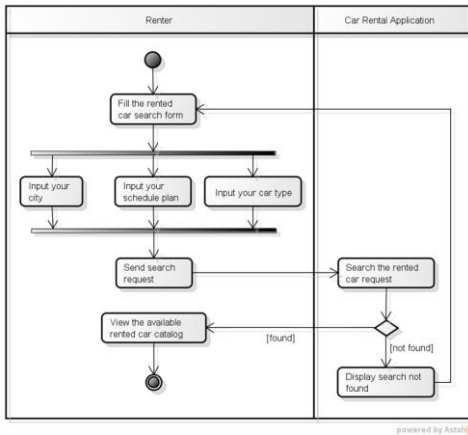


Figure 6 Activity Diagram for Searching the Availability Rented Cars

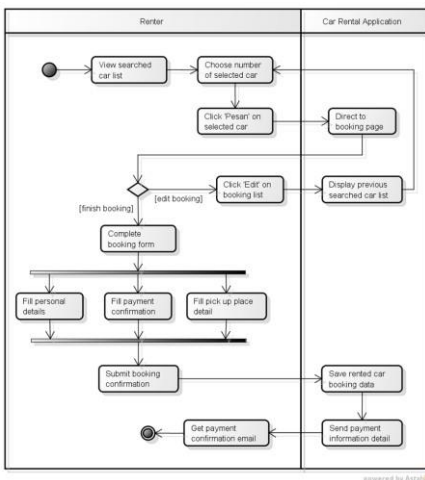


Figure 7 Activity Diagram for Booking the Selected Cars

D. Application and Technology Architecture

To build Nyewamobil.com in form of web application for car rental management based on crowdsourcing focused on customer side specifically, it cannot stand alone without centralized database server. That is because this research application needs to get the availability of rented cars from all rental partners, in which the web application for rental administrator stands separately from application for customer. Thus, Nyewamobil.com for rental and customer will be bridged by centralized web and database server, as shown in Figure 8. By using Internet, customers can get the rented cars information based on the availability in every rental partners.

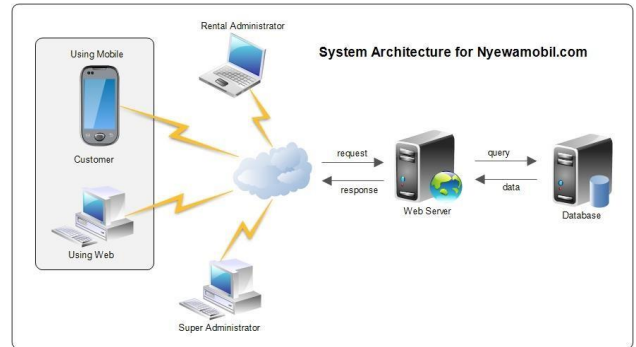


Figure 8 System Architecture for Nyewamobil.com

In addition, application unit static model that interacts at each other on this research application will be represented into domain class diagram in Figure 9. It shows some models used for controller and view in running this application.

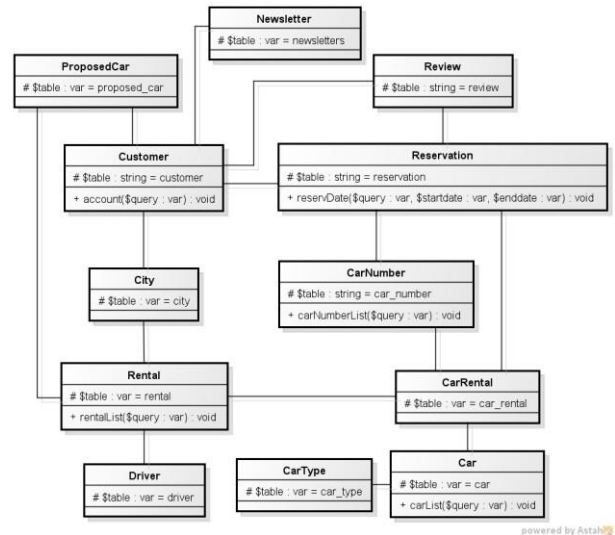


Figure 9 Domain Class Diagram for Nyewamobil.com (Customer)

E. Result of Application

The following is the result of application interface on Nyewamobil.com in form of website based on crowdsourcing focused on customer side specifically. Only some interfaces will be displayed below.

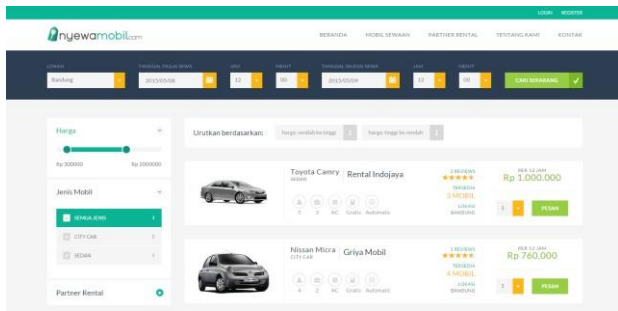


Figure 10 Page for Searching the Rented Cars and its Result

Figure 10 shows one main function existing on Nyewamobil.com. This page will appear after customers have fulfilled the searching form on homepage.

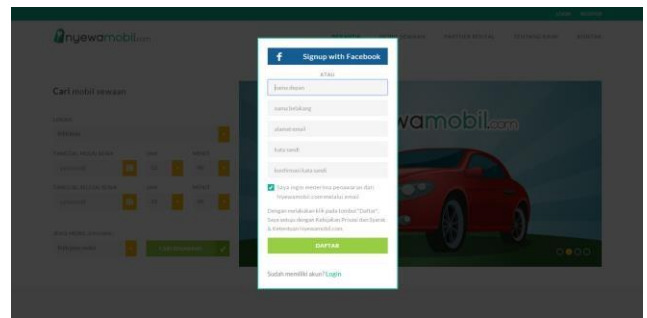


Figure 13 Page for Member Registration

Figure 13 shows registration form in which customers can choose registering by Facebook account or email. After doing this, they can edit their profile directly.

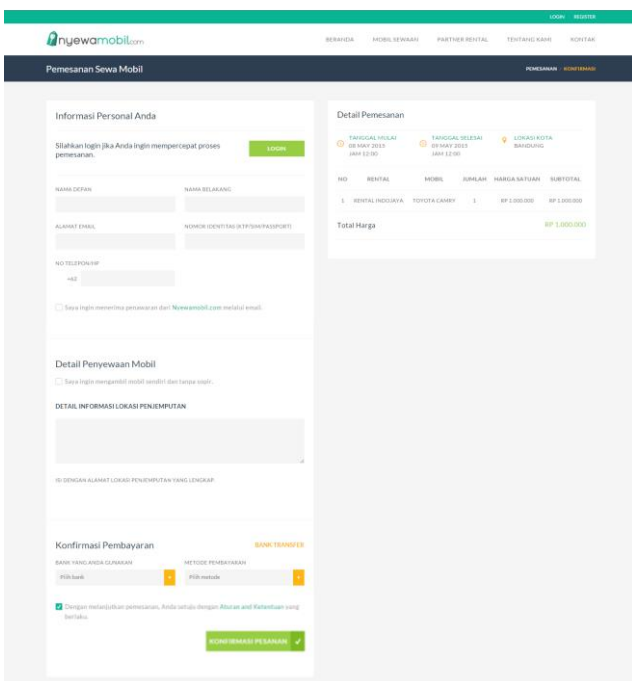


Figure 11 Page for Booking the Rented Cars

Figure 11 shows booking form when customers want to complete their bookings until payment. This page will appear after customers have selected the rented cars they want as needed.

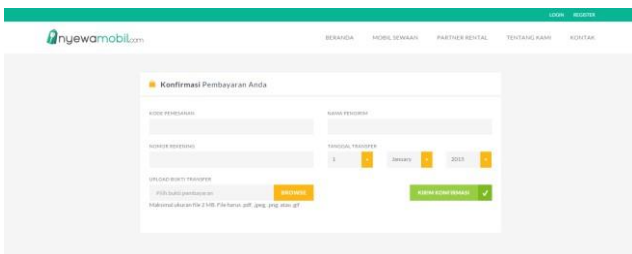


Figure 12 Page for Doing Payment Confirmation

Figure 12 shows form to be fulfilled by customers for confirming their payment in order to get information their booked cars detail.

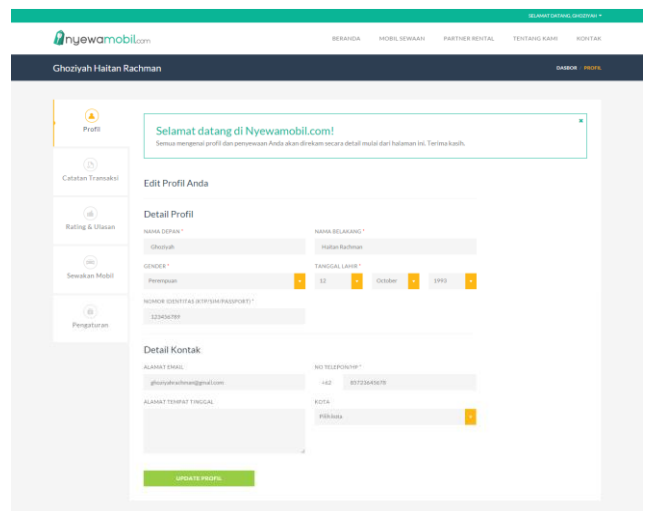


Figure 14 Page for Profile Management

Figure 14 shows form for editing member's profile directly after doing registration.

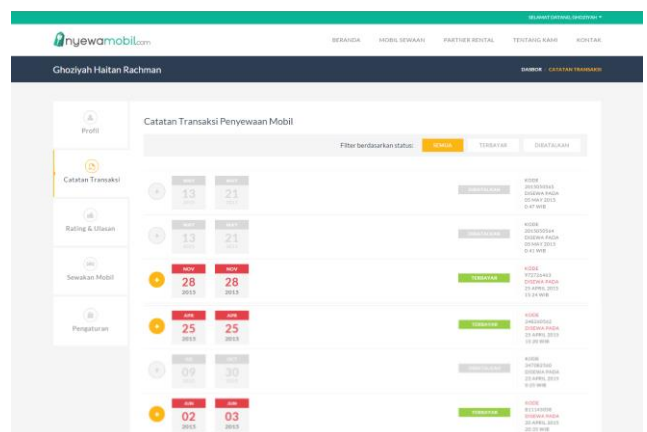


Figure 15 Page for Viewing Transaction History

Figure 15 shows transaction history from member. By clicking plus circle button, member can see the detail of each their reservation. Each status is also appeared on the right side.

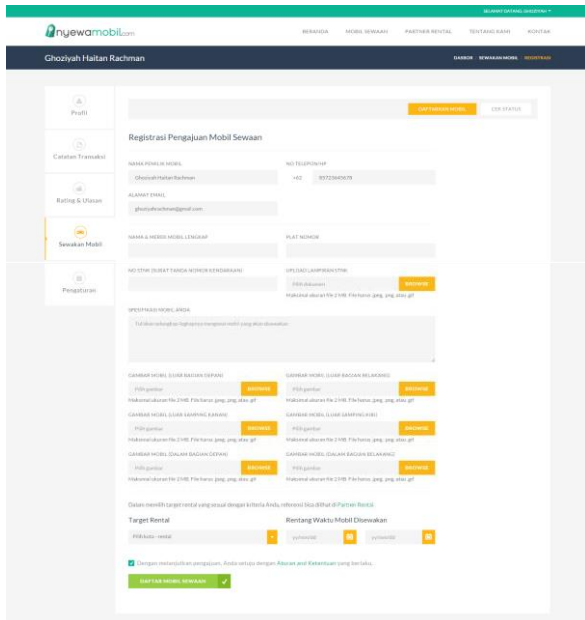


Figure 16 Page for Proposing Car Personally

Figure 16 shows form for proposing member's cars personally to their target of rental partner. After that, member can see the status of each their proposed car whether that is accepted or rejected.

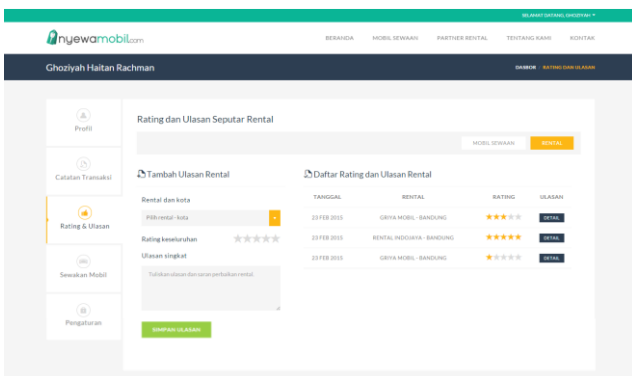


Figure 17 Page for Rating and Review

Figure 17 shows function for rating and review cars and rentals. After doing this, they can see their review history on the right side for rental especially.

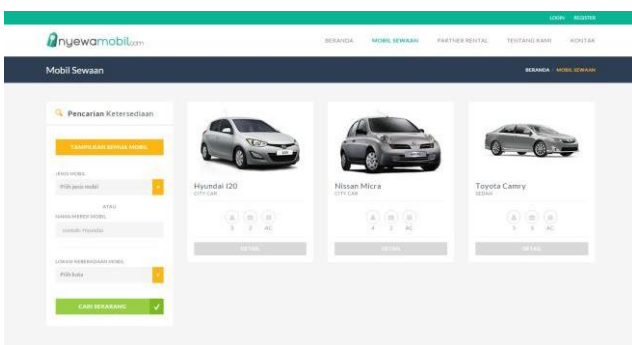


Figure 18 Page for Viewing the Cars Catalogue

Figure 18 shows cars catalogue generally existing on Nyewamobil.com. On the left side, customers can search the availability of those cars based on rental city, car type, and car name. Then, they can also see its details.

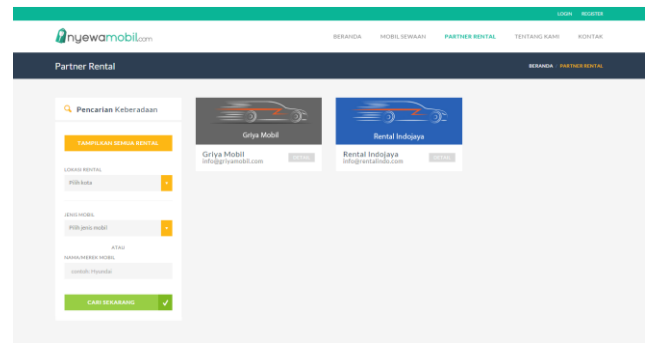


Figure 19 Page for Viewing the Rentals Catalogue

Figure 19 shows rentals who have formed a partnership with Nyewamobil.com. On the left side, customers can search the availability of cars in those rentals based on car type and car name as well as search rental partner based on city. Then, they can also see its details.

V. IMPLEMENTATION AND TESTING

For doing implementation, this research application needs web browser and Internet to access data from database server through web server. Nyewamobil.com focused on customer side specifically is built by using programming language of PHP with Laravel framework, MySQL for database, and Apache for web server. This application has been tested on some web browsers, namely Google Chrome version 42.0.2311.135 m, Mozilla Firefox version 37.0.2, and Internet Explorer 10. Its result is that functionalities on Nyewamobil.com still works well.

In addition, testing is done also to check application functions whether those are running without or within error. Tests performed on this research application use black box testing, in which tester does not need to check until the code exiting on internal application. The result of testing for Nyewamobil.com for customer is shown in Table 1.

TABLE 1
 TEST RESULT OF NYEWAMOBIL.COM (CUSTOMER)

No	Test	Expected Result	Result
1	Search the rented cars	Show the availability of rented cars from rental partners	Passed
2	Book the rented cars	Show the detail of booking and get confirmation email	Passed
3	Do payment confirmation	Show notification whether confirmation is successful or not	Passed
4	Register as member	Show member profile and get confirmation email	Passed
5	Edit profile	Show notification whether editing is successful or not	Passed
6	View the	Show all transactions	Passed

	transaction history	for member especially	
7	Propose car personally	Show status whether proposed car is accepted or not by rental	Passed
8	Do rating and review	Show review history made by member	Passed
9	View cars catalogue	Show list of cars as well as its details	Passed
10	View rentals catalogue	Show list of rentals as well as its details	Passed
11	Share information by social media	Show certain information about cars and rentals to social media timeline	Passed

VI. CONCLUSION

Conclusions for this research are as follows:

- 1) By using web application for car rental management based on crowdsourcing for customer specifically, renter candidates as customers can easily find information of the rented cars availability from various rental partners. This can be bridge between renters and car rentals for doing booking process. In addition, with this application, customers can book multi-cars more efficiently and effectively without come directly to their addressed car rentals.
- 2) This research application combines crowdsourcing and e-commerce concept to make booking rented cars from various rentals until doing payment confirmation become easily than before, in which traditionally renters always do those processes directly in only one addressed car rental.
- 3) Sharing cars and rentals information through social media account will make those promotion spread faster electronically. This is one of the ways to ease good rentals for reaching many customers from customers.

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