Application Design of Fraud Detection on at the Gas Station

Farkhan Atoillah[1], Ratna Purwaningsih[2], Aan Aria Nanda[3], Azizah Dewi Suryaningsih[4]

[1]Department of Industrial Engineering, Diponegoro University, Semarang, Central Java, Indonesia-50275
[2]Department of Industrial Engineering, Diponegoro University, Semarang, Central Java, Indonesia-50275
[3]Department of Electrical Engineering, Diponegoro University, Semarang, Central Java, Indonesia-50275
[4]Department of Urban and Regional Planning, Diponegoro University, Semarang, Central Java, Indonesia-50275

Abstract— *The objective of this paper is to design applications that can be used to detect fraud committed by gas station management. The design was developed based on the Product Design and Development methods. There are seven stages in developing a product. However, in this paper only analysis until the fourth stage is presented, namely choosing the concept of the product to be developed. Input data as a basis for analyzing consumer needs was obtained through questionnaires to 300 respondents. The result is that the majority of consumers are not aware of the fraudulent action that is supported by the absence of an evidence methods that can be carried out by consumers. According to the results, the application called MAITEC is designed based on android systems with the aim of comparing the amount of fuel filled into the tank with the data written on the purchase note. This application is developed with Waterfall Model based on consumer needs analysis and target specifications that were able to identify three types of fuels, namely Premium, Pertalite, and Pertamax.*

Keywords— *Fraud, fuel, refueling, gas station, android systems.*

I. INTRODUCTION

The use of motor vehicles, in particularly private transport, is increasing every year. Sales of motorcycles increased up to 18.09% by the end of 2018 and also in line with the fuel requirements [1]. As a result, there is an imbalance between fuel demand and production then encourage some seller to practice fraud for profit. Scams are in the form of reducing dose by playing nozzle or fuel filling machines.

The presence of the gas station, also called SPBU from Pertamina Company is closely related to the people in their daily lives [2]. Although, the SPBU (the term for gas station in Indonesia) must be closed in several times due to fraud committed by the management. Not only that, Pertamini as a fuel distributors are also suspected to be cheating due to lack of business licenses and standardized tests by the Metrology Agency [3]. These various frauds place consumers as victims, especially because there is no way to prove fraud directly by consumers.

Based on the previous research, the phenomenon that occurs is that consumers prefer to be quiet and do not make any efforts towards fraud committed by gas stations [4]. This happens because there is no means to complain and prove fraud by consumers to the authorities. Besides the technological developments have given huge contribution to the human life. In order to monitor and control the use of electronic devices, technology can be used as a tool to detect the fraud practice of fuel distributors.

This paper proposes an automatic system in monitoring the fuel filling that is connected by microcontroller and controlled by a smartphone in android systems. The focus of this study is to choose an application design that fits the needs of the community, especially consumers by combining two research methods, namely Product Design and Development by Ulrich and Waterfall Model. The alternative application concepts are selected based on analysis through interviews with 300 respondents. In order that, this system is proposed to cover problems faced by consumers such as the difficulty of getting information about how to prove an report the fraud when refueling at a gas station.

II. RESEARCH METHOD

A. Product Design and Development

Design activities or design product is the most important and absolute things to do before the production process of an object occurs. That is because at the product design stage, the information will be obtained regarding detailed descriptions or details of objects to be produced, thus facilitating the production process [5].
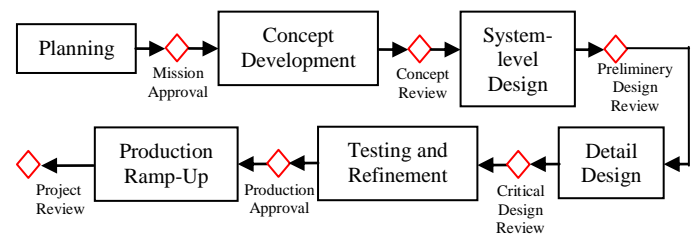

Fig. 1. The Stage of Product Planning and Development

Based on the Fig. 1., the concept of product design and development according to Ulrich and Eppinger consists of six main stages. The concept then experiences the development that forms the activities that interact in more detail [6].
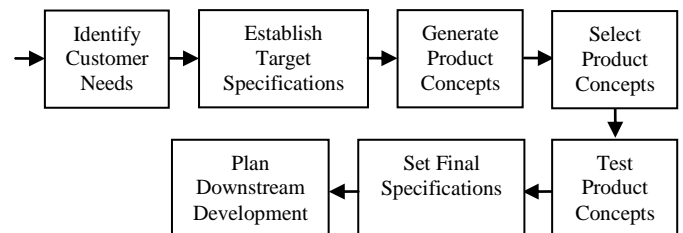

Fig. 2. Identification of User Interactions with Needs and Desires with Other Activities in Concepts Development

In the step of identifying the needs and desires of the user as shown on Fig. 2., the things to do done is to ensure the product is required by the user, the product is a hidden requirement even by the user, facts are available specifying product specifications, and can provide the same understanding user requirements for the entire concept development team. Identify customer needs used the interviews and questionnaires with 300 people taken randomly. After obtaining a questionnaire result, the product is then developed based on the desired consumer target. The concept of the product is designed according to consumer needs.

B. Waterfall Model

Another method of development is also to unify prototypes that have worked with software in the form of android applications, the method of developing a waterfall system, which is a systematic and sequential system of information system development [7].
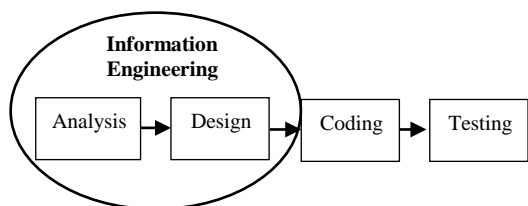

Fig. 3. Basic Waterfall Model

Fig. 3. illustrates the basic model of waterfall, which is one of the main system development models. Stages were set as a series of sequential steps with the flow of time and information from left to the right [8]. The model defines the order stages that will be delivered completely to the management at the end of each stage. It is also the most widely used methodology in the software development industry.

III. RESULT AND DESIGN CONCEPT

A. Identify Customer Needs

Based on the first stage of Product Design and Development by Ulrich, this study gave questionnaires to 300 respondents taken randomly to find out the main factors driving fraudulent behaviour by the gas station management. As for the results of respondent's answers are as follows in the Fig. 4.
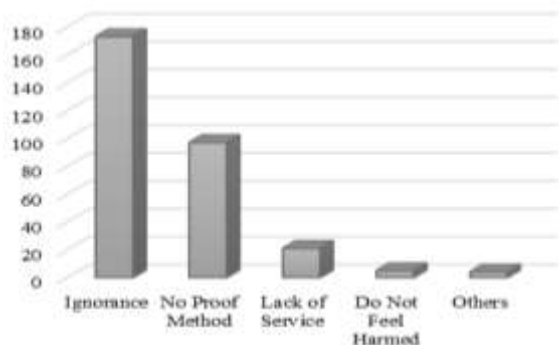

Fig. 4. The Driver Factor for Fraud in Refueling

Fig. 4. Shows that the biggest factor driving fraudulent action at the gas station was the ignorance of the respondents. There is no evidence that can be known to consumers. Therefore, they didn't realize that the fraud had been done. There's also no proof method to know the fraudulent action.

Based on the result above, consumers need a proof method of fraudulent action in the gas station to eliminate their ignorance. Besides, the proof method also needs to be designed practically. So that it is easy to use by consumers. Therefore, this study was conducted to design an application that is easy to use by consumers to detect the fraudulent refueling actions at the gas station.

Applications that can be used to detect fraudulent acts when reporting to police are required by the user. This can be seen in the results of customer needs analysis, where most respondents make ignorance of key factors driving fraud at gas stations. To make an application concept that fits the needs of consumers, the target specifications are carried out.

In the second stage of Product Design and Development by Ulrich, market segmentation or the target phase of consumers is a matter of consideration. The way that can be done to determine the target specification is to classify the user. In this study, user groups were differentiated based on the type of vehicle they owned. Data were analyzed based on 300 respondents who had been interviewed before.

TABLE I. The Distribution of Fuel Consumers by Type of Vehicle Owned

Type of Fuel	Type of Vehicle Owned		
	Motorcycle	Car	Bus / Truck
Premium	106	4	0
Pertalite	83	19	0
Pertamax	30	33	2
Solar	0	2	21
Total	219	58	23

According to the Table I, it is evident that most consumers (73%) are motorcyclists with Premium fuel types. Premium is the cheapest fuel available amongst others. However, according to the Badan Pusat Statistik (central statistical agency in Indonesia), the reduction in the amount of premium fuel or fraud is more common because it is cheap and often bought by motorcyclists. In addition, Pertalite fuel is also often purchased by users. In addition to low prices, the quality is better than Premium. Based on the analysis of target specifications, it can be concluded that the main target in this study is motorcycle riders. In other that, the types of fuel that will be the main variables in this study are Premium, Pertalite, and Pertamax.
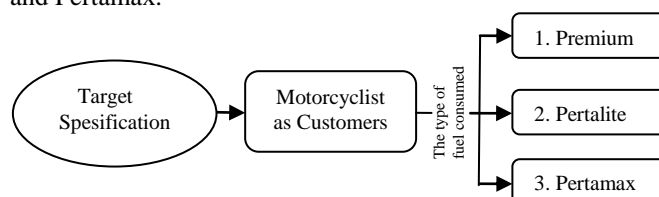

Fig. 5. The Main Target Specifications

C. Generate Product Concept

After knowing the target, the next step is to determine the choice of product concept to be developed. Therefore, it takes

16

some special aspects that suit the needs of consumers. The aspects that are considered are as follows.

TABLE II. Technical Responses to Consumer Needs

Attributes (Aspect to be Considered)	**Technically Response**
Easy to Use	Media base selection
Design	Selection of product colour
Ease of Carrying	Product are made simple and can be carried everywhere
Side Benefits	Added Features

Based on Table II, it can be seen that there are four main aspects that are adjusted to the needs of consumers. The four aspects are the basic concept of the fraud detection applications at the gas station. Considering these aspects, two alternative concepts can be developed which can be further developed.

D. Select Product Concept

The fourth stage that must be done in line with Ulrich's Product Design and Development theory is to select the concept to be developed based on the alternatives available to the consumers. Based on the opinions of respondents in this study, an alternative concept was obtained which could be further developed as follows.

TABLE III. Alternative Concept Selection

Technically Responses	**Concept of Ideas**	
	Alternative 1	**Alternative 2**
Media Base Selection	1. Android based application	1. Website
Colour of Product	2. Colour selection has meaning according to its function	2. Colour selection is only based on style
Pageviews / Interface	3. Design of the product is simple and attractive 4. The menu is made of one simple layer	3. Design of the product is simple and attractive 4. There's a stacked menu
Added Features	5. Given a guide 6. Given a call centre menu 7. Given the latest fuel cost chart menu	5. Given a guide 6. Given a contact by e-mail menu 7. Given the information of gas station distribution

The two alternatives listed in Table III show choices that can be developed into the main concepts of the application. The alternative chosen is number one, which according to respondents has the main aspects needed by consumers. The application will be made based on Android which can be accessed via a smartphone. It can help the consumers to find out the fraud that occurred quickly. The color used as the theme of the application will be made according to the meaning that will be displayed. The theme chosen is blue which symbolizes one type of fuel. In addition, the menu page is made simple with one layer to make it easier for users to know each function. To help users find functions from each available menu, a guide is available that can also be accessed on the application. Besides, the application also designed with the other service to customers such as a fuel cost chart information and call centre to report the fraud action. After

knowing the chosen alternative, the next step is to determine the application design based on the concept.

Considering the results of selected alternative concepts, the application design was made to support consumer needs in order to detect fraud at the gas station. Android-based applications are developed with the waterfall method. The first step is to do a needs analysis as has been done with the Product Design and Development method by Ulrich. The next step is to make a display or interface design.

Fig. 5. Main page of the application and registration

This application is named MAITEC, which stands for automatic detection. To use the application, the first step that must be done by the user is to log in using e-mail and password. Display is made simple to make it easier for users to access every available feature. Besides, the application contains the main and additional features to attract consumers and motorists to use this application.
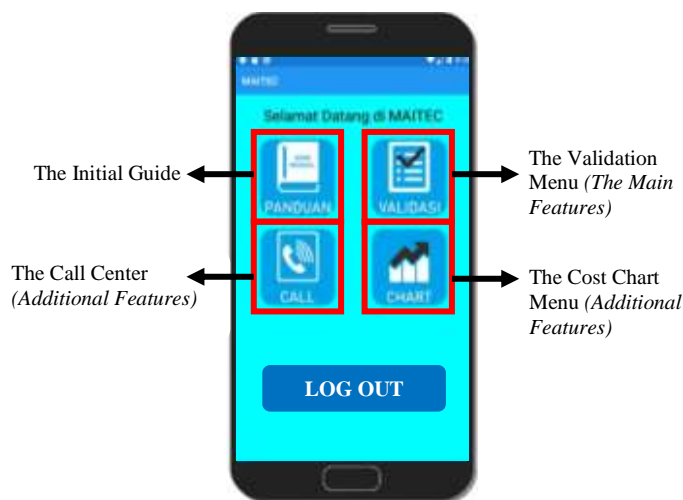

Fig. 5. Feature page

In order to facilitate the use of the MAITEC application to detect fraud in refueling, users can first read the user's initial guide available on one of the application features.

Fig. 6. Initial Guide for Users

The initial guide in the Fig. 6. contains the steps that must be taken by the user to compare the amount and price of fuel that is filled into the motorbike tank with the results of calculating the nozzle machine (fuel filling machine) through the purchase note.
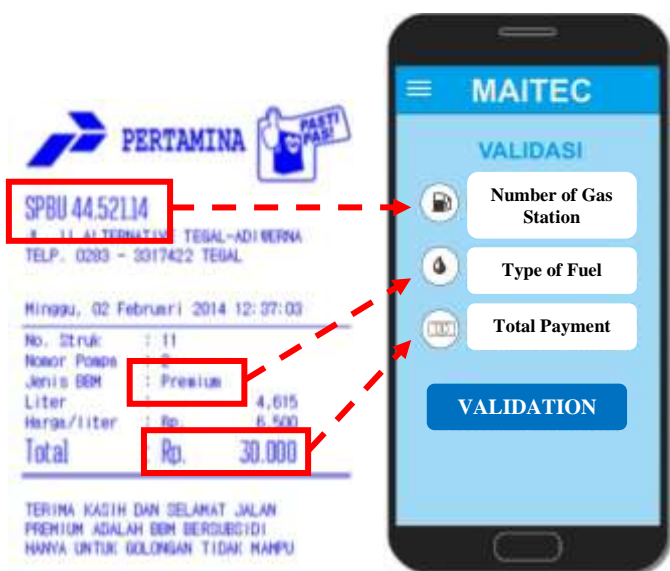

Fig. 7. How to Use The Validation Feature

The validation phase is an important point from the use of the MAITEC application. The procedure for using the feature is to enter the gas station number, the type of fuel purchased, and the total payment issued by the buyer. Adjust to the purchase note that has been obtained. Validation features in the MAITEC application can be used if each motorcycle owned by a user is equipped with a sensor device. The sensor is a series of applications where the device will calculate the total fuel filled in the motorbike tank. As same as the results of consumer needs analysis, sensor devices are specifically designed for motorized tanks as the most used vehicle. After the sensor detects the fuel that is filled in the tank, the data

received will be automatically sent by the microcontroller and entered into an android-based application that has been installed. Therefore, the validation feature can be used by entering the amount and type of fuel purchased as shown in the Fig. 7. After that, the application will compare the results of the sensor calculation and the data listed on the purchase note.
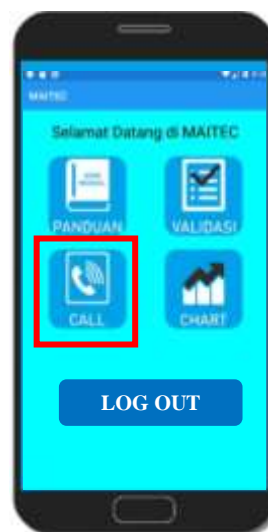

Fig. 8. The Call Centre Features

If validation of fuel purchase data shows that fraud has occurred, then consumers or MAITEC application users can report automatically to the authorities using the call center feature shown in Fig. 8. This feature will connect consumers to gas station service providers. The results of validation and payment notes can be the main evidence in reporting such fraudulent actions. In that way, consumers can directly follow up on fraud that has occurred. It can help the consumers who want to wipe out the fraud.

Fig. 9. Cost Chart Features

18

To provide additional features as a side benefit from the MAITEC application, a cost chart feature is provided to find out the current price of the fuel as shown in Fig. 9. The prices listed on this application are real time, so users can match these prices with market prices at the gas station. Another goal of the cost chart feature is to provide education to the users regarding the graph of the current fuel prices.

IV. CONCLUSION

Based on the results of the analysis that has been carried out, it can be concluded that the MAITEC application needs to be developed to help the community, especially motorists, to avoid the fraud action by the gas station management and provide users with the opportunity to directly report suspected fraud to the authorities.

REFERENCE

[1] *Indonesian Statistics Data*, Statistik Kendaraan Bermotor di Indonesia, Jakarta, 2018.

[2] Didit Pradita Hananta and N.K. Supasti Darmawan, "Pelaksanaan Tera Ulang sebagai Upaya Perlindungan Konsumen dalam Menekan Kecurangan SPBU di Provinsi Bali," *Jurnal Ilmu Hukum*, vol. *1*, issue *3*, pages *11-16*, 2013

[3] Farkhan Atoillah and Azizah Dewi, private communication, 2019.

[4] Aisyah Rahmalia, "Alat Ukur Volume BBM Berbasis Arduino untuk Mencegah Kecurangan Pada Pengisian di SPBU," Computer Group Repository of Sumatera Utara University, Paper SP-Physics 766.

[5] Rosnani Ginting, *Perancangan Produk*. Yogyakarta : Graha Ilmu, pp. 23–24, 2009.

[6] K.T. Ulrich and Steven D. Eppinger, *Product Design and Development*. Boston : McGraw Hill Co. 2003.

[7] R.S. Pressman, *Rekayasa Perangkat Lunak - Pendekatan Praktis, 2nd Edition*. Yogyakarta : Penerbit Andi, pp. 12–15, 2002.

[8] I. Sommerville, *Software Engineering, 9th Edition*. USA : Addison-Wesley, pp. 32-34, 2010.