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Building A Smart Vehicle Registration Certificate Prototype Using RFID

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Abstract— *The Indonesian government requires a system capable of identifying vehicles since imposed restrictions on the use of subsidized fuel. This research aims to build a smart vehicle registration which allows a vehicle registration as a means of identifying the vehicles data wirelessly or contactless. Systems built using RFID technology. This study resulted in four prototype models developed into a smart vehicle registration certificate prototype (e-STNK).*

Keywords **— vehicle registration certificate; RFID; e-STNK; prototype.**

I. INTRODUCTION

Identification of motor vehicles entitled to use subsidized fuel policy becomes key to successful implementation. This study aims to produce a system that is able to identify recipients of subsidized fuel vehicles intelligently [1] [2]. The use of Smart labels enables the system which automatically recognizes vehicles coming into gas stations. A reader will be installed in every gas station. A label will be given on motor vehicle which is able to provide information about the motor vehicle, including its rights to use subsidized fuel. In the final year of this study, a prototype smart vehicle registration (Vehicle registration number) is designed to be able to identify the feasibility of a motor vehicle to get subsidies. The identification process of the motor vehicle can be done more effectively and efficiently, so that the restriction of the use of subsidized fuel-matter can be precisely targeted.

II. LITERATURE REVIEW

Kumar et al [3] proposed a vehicle tracking system using RFID Tag campus. The tracking scheme does not use a certification mechanism, so it is quite lightweight and fits in a campus environment. The approach of the research is a vehicle tracking scheme based RFID tags, which is able to detect all the vehicles in the Campus and prevent the campus from unauthorized vehicles.

In 2007 Eric et al, patented research on smart meter parking systems [4] which serve as guidelines for developing a license plate recognition system and tracking system of motor vehicles.

Another study conducted by Perez et al [5] presents an architecture for automatic adaptation of the vehicle longitudinal speed control that can help reduce one of the main causes of accidents. This research approach is based on a combination of different sensor technologies: RFID tags from traffic signals to convey information to the car and put on the Hall sensor wheels of the vehicle to high accuracy measurement speed of the car.

Goyal and Singh [6] used RFID for build an security system for vehicle. RFID used to detect the vehicle number plate. The system is implemented in matlab and tested on real image.

Widiasari [7] implemented smart label as an identifier of feasible motor vehicle status to get subsidized fuel.

III. METHODOLOGY

The research focuses on the design of object identification system using smart label technology. Furthermore, this technology is combined with wireless technology to be able to identify objects wirelessly or contactless. At the end, the smart design of prototype vehicle registration is done and the smart label will be attached to the vehicle registration of vehicles so that it has the capability to collect vehicle registration data wirelessly or contactless.

The system is designed by using the Waterfall method that consists of system requirement, system design, implementation, testing and integration, and maintenance. Waterfall method is presented in Figure 1.

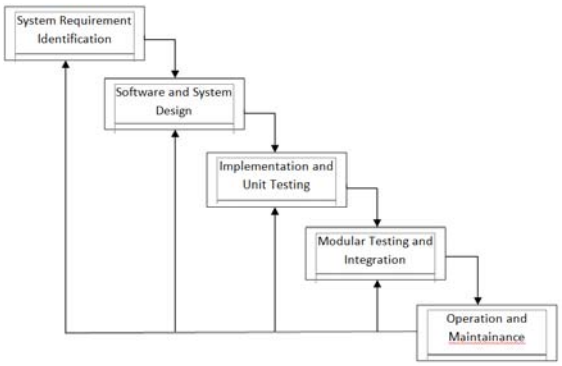

Figure 1: Waterfall Model [8]

Stages of design in Waterfall method are as follows:

• In the first phase, system requirements and identification is performed. System requirement is done by searching the system requirement data, such as vehicle registration data, certificate of ownership of motor vehicles data, tax payment data, and data validation. Furthermore, identify the needs of the system, in the design of intelligent systems for the identification of motor vehicles subsidized fuel restriction, the purpose of this phase is to determine the scope of information to be recorded on the Smart Label and knowledge for users and administrators.

According to Widiasari [7] the memory allocation in RFID is shown as in Table 1. The field name is matched with the information in accordance with the motor vehicle letters so as not to remove any information from the vehicle, while the field length determines how large the field occupies the memory space on RFID. The fieild length is adjusted to the memory capacity owned by RFID. In this table, we also provide examples of contents or formats for each field (adapted to the conditions in Indonesia, where this research is conducted)

Table 1
Memory Requirement on Motor Vehicle Identification

Field Name	Field Length	Example	Information
Vehicle Registration Number	9 digit (without -) or 11 digit (with -)	AB-1234-CDE	
Owner's Name	20		
Address	50		
Job	20		
ID Number	19		
Brand	2	Honda	Lookup table
Type	15	NF11B1D MT	
Kind of vehicle	2	Motorcycle	Lookup table
Model	2	Solo	Lookup table
Year of Manufacturing	4	2016	
Cylynder Capacity	6 digit (without -) or 7 digit (with-)	1299-CC	
Vehicle Identification Number	17		
Vehicle Engine Number	12		
Colour	2	Black	Lookup table
Fuel	2	Bensin	Lookup table
Vehicle license number plate color	2	Black	Lookup table
Year of registration	4	2016	
Certificate of Motor Vehicle Owner Number	10		
Number of Axis	1	6 (truck trailer)	
Number of Wheel	2	22 (truck trailer)	
Invoice Number	14		
Importer	20		
TOLLBOOTH INFORMATION			
PIB Number			
SUT Number			
TPT Number			
Form A/B/C numbers			Built up vehicle
Office of Customs			
Auction Number			
Skep DUM TNI/Polri number			
CHANGE OF IDENTITY			
Change	60		
Type of Change	2	Change of vehicle identification number	Lookup Table
Released in	15	Ujung Pandang	
Date	10	31-12-2016	
POLICE NOTES			
Police Notes	150	Maju Jaya certificate No. 123456 date 31-12-2016 says that the vehicle has changed the shape of the light trucks to station wagon	Used for police notes

• Design of systems and software, this phase includes the user interface design, information database design, network design and the design of multimedia systems. Then the identification data is used to design the system, which consists of database design, user interface, data validation, and connectivity to RFID antenna. The system must be able to read data coming from the RFID input antenna properly, so that input can be used for the next process such as vehicle recognition, owner recognition, and tax payment.

• Implementation and testing, this phase includes coding (coding and testing of each unit of the system). At this stage the system implementation is done by making the modules which then will be combined into a complete system. Modules are made in accordance with the design system, if there is a change in the module it will be re-adjusted to the needs of the design system.

• Modular Integration and testing, in this step, each unit of the system is integrated and tested as a whole to obtain optimal system performance. Testing is performed on every module created, such as database module, user interface, data connection, and RFID. After the module can run well, then the system will perform the module integration process testing, where each module will be connected to the system. Testing is done on each data entered on the system, the results of the process will be adjusted with the output. If all data, between the input and output has been appropriate then the integration testing system has been successfully implemented.

• The last stage is the operation and maintenance of the system periodically as needed.

IV. Result and Discussion

A. Software Design of Motor Vehicle Identification System

Based on the mapping information needs of motor vehicles, then a database is designed which consists of seven parent table, one transaction table and seven lookup tables.

The seven parent tables are as follows:
- Table Owner
- Table Vehicles
- Table of vehicle registration
- Invoices Table
- Table Customs
- Table Changes
- Table Notes Police

One transaction table is a table that connects all SmartLabel parent table. The seven lookup table are:
- Brands
- Type
- Model
- Color
- Fuel
- Color of vehicle license plate number

All information about motor vehicle will make it easier to detect the feasibility of a vehicle to receive subsidies or not. The information used to determine eligibility to receive subsidies based on the number of wheels, the vehicle model and color of vehicle license plate number. The result of interface design system is shown in Figure 2 through Figure 5.

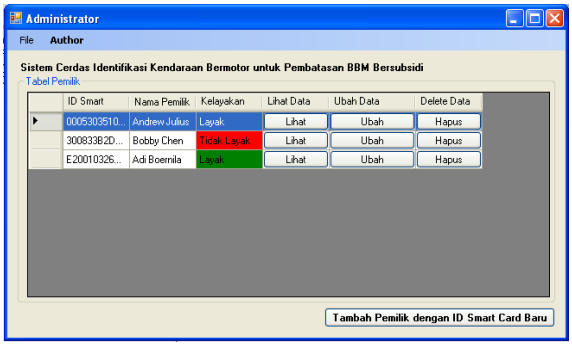

Figure 2: Administrator page

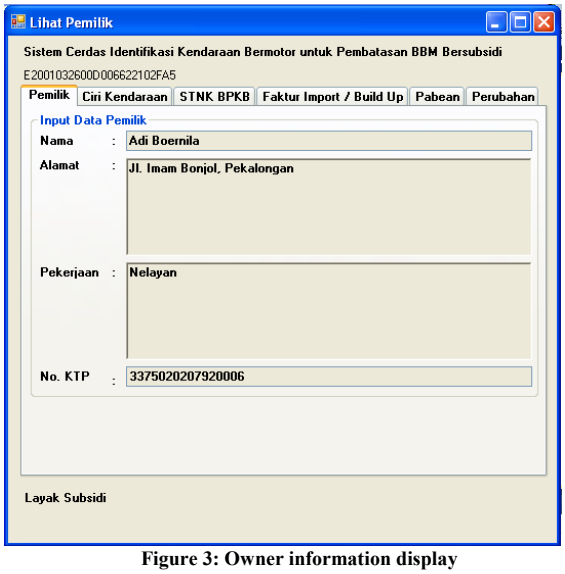

Figure 3: Owner information display

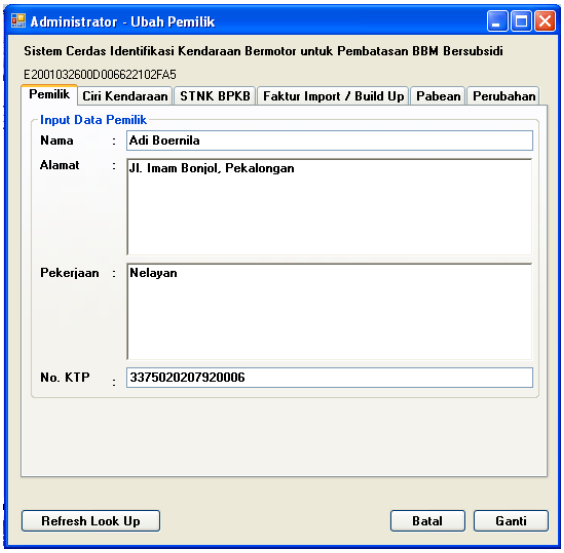

Figure 4: Owner's data editing display

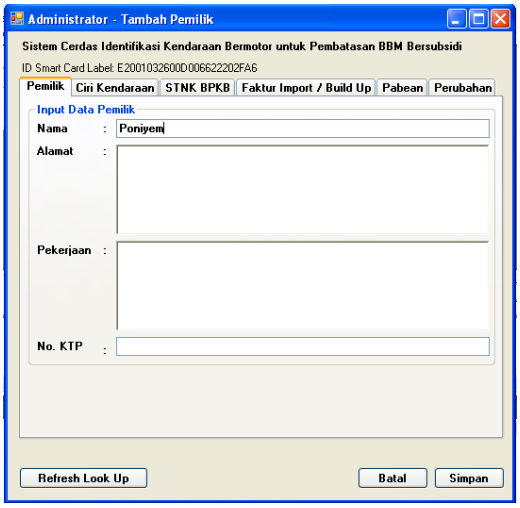

Figure 5: Add data display

B. Design of Motor Vehicle registration number certificate

The motor vehicle registration number certificate is designed in various sizes and types of information contained in the letter.

1. Design Type 1, the design is created based on the official Motor Vehicle registration number certificate by eliminating unnecessary information. This is because the information has been entered into the data RFID label.

Information that has been added, such as the Term Letter, legalization and Signature Validation. The results of the design of Motor Vehicle registration number can be seen in Figure 6.

Figure 6: Design 1 vehicle registration certificate

2. Design Type 2, the design was created based on the official Regional Tax Assessments PKB / BBN-KB, SWDKLLJ, AND PNBP with some changes which is by eliminating unnecessary information on the displayed certificate. This is because the information has been entered into the data RFID label. Some information entered in the system are the Term Letter, No. Sort, and Total-To-Be-Paid (Rupiahs). The results of the design of Motor Vehicle registration number can be seen in Figure 7.

Figure 7: Design 2 vehicle registration certificate

3. Design Type 3, the design is created based on the official Motor Vehicle registration number certificate by eliminating unnecessary information. This is because the information has been entered into the RFID card data. The information displayed on the certificate includes the Registration Number, Owner Name, Address, Brand, Type, Color, and Fuel. While the other information that has been entered into the RFID data, such as the Term Letter, Information Engineering and Frame, Year, and Validation. The design of Motor Vehicle registration number can be seen in Figure 8.

Figure 8: Design 3 vehicle registration certificate

4. Design Type 4, the design is created based on the official Motor Vehicle registration number certificate by eliminating unnecessary information. This is because the information has been entered into the RFID card data. The design has a photo image of motor vehicles used to facilitate the introduction of each vehicle.

The information displayed on the certificate includes the Registration Number, Owner Name, Address, Brand, Type, Color, Fuel and Vehicle Photos. While the other information that has been entered into the RFID data, such as the Term Letter, Information Engineering and Frame, Year, and Validation. The design of Motor Vehicle registration number can be seen in Figure 9 and Figure 10 .

5. Back-Side Card Design, Back-side design will consist of an image of Garuda Pancasila (state symbol of Indonesia), Indonesia map image, and the hologram. Hologram is required to validate the authenticity of the card. The results of the design of Motor Vehicle registration number can be seen in Figure 11.

Figure 9: Design 4 vehicle registration certificate

Figure 10: Design 4 vehicle registration certificate (2)

Figure 11: Back side design of vehicle registration certificate

In the E-vehicle registration certificate, vehicle tax information is also stored in RFID. The information stored are the transfer duties - Vehicle, motor vehicle tax, Contribution Obligation Fund Accidents Road Traffic, Administrative vehicle registration fee and vehicle registration administration fee. They will be stored in a table Taxes.

In addition to tax information, other information stored are Tax Determination Date, Determination Officer, correctors, the police chief and the due Date.

Officers obtained a tax assessment that user input on Tax Determination Form and the settlement date will be deducted from the user time doing data entry tax. Form This determination will be made globally for the entire vehicle by looking at the factors considered by the relevant section, while consideration is done bias from the vehicle, a cylinder and brands.

Corrector is obtained from user filling the form of tax correction, requested the contents of this form to approve or

not the proposed tax by the previous determination officer. If there is no correction of the tax, then set to be valid, unless it will return to the tax assessment officer.

Name section of the regional police chief will be obtained from the configuration is done on this Intelligent System, when the regional police chief is replaced then there will be a change in setting name.

After all the configuration of the vehicle tax has been done then continue on the motor vehicle tax through tax input form. filing form through Input Tax. Input Tax Form will be processed with the following flowchart shown in Figure 12.

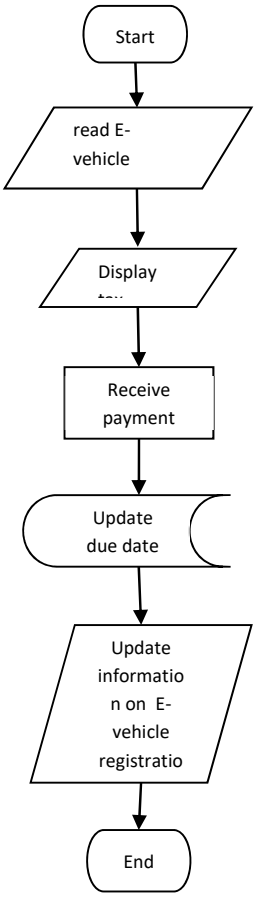

Figure 12: Input Tax Process Flowchart

Flowchart tax payment is a procedure performed for tax payments manually or during the transition period to transfer the E-vehicle registration system. If all vehicle registration has been changed into E-proposed vehicle registration process online payments through the bank either through ATM or internet banking.

If the tax payment is made online then done enough vehicle owners to update the card at the vehicle registration renewal. The update process will follow the following flowchart shown in Figure 13.

Online payment process will be more helpful in the process of vehicle registration renewal, because the vehicle owner can pay via ATM or internet banking by entering the vehicle registration number. The vehicle registration number entered will display the amount of bills to be paid. Once the tax bill is paid, the due date in the database will be updated and vehicle owners simply need to visit part of the extension of the E-vehicle registration capabilities to tap E-vehicle registration to update the information that is in its E-vehicle registration.

By integrating the online tax payments, it is expected to reduce queues that occur at the vehicle registration renewal.

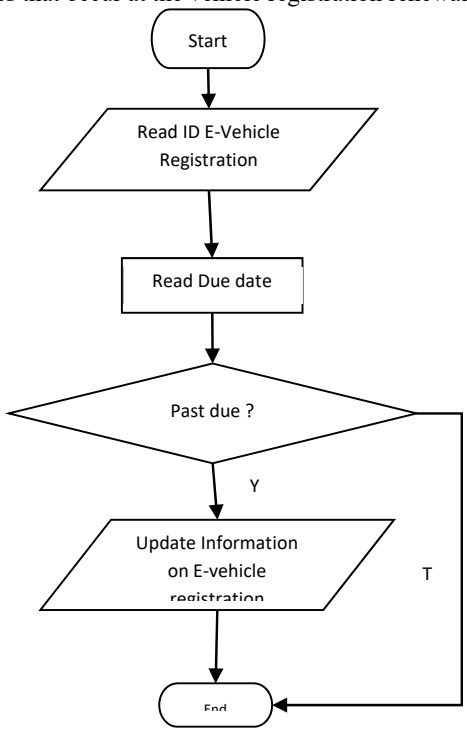

Figure 13: Update Process Flowchart

V. CONCLUSION

The research shows that the data stored in the smart label can be used to display the status of vehicle fuel subsidies. The data stored in the smart label is the same as the data registration, and data used to determine the status of the vehicle subsidy is the year of manufacture, the contents of the cylinder and the color of motor vehicle number sign.

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