

# Development of decision support system for subsidized electricity purchase using Naive Bayes method to improve company reputation (Case study in PT. PLN (Persero) Malang)

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**Abstract.** Nowadays there are a lot of customers who are categorized as capable households (Rumah Tangga Mampu). The problem is, electricity rates increased to IDR 1,352,00/ KWH for customers with average capacity (900 Volt Ampere). Central government spending the proportion of electricity subsidies tends to rocketed up from 2.5% in 2005 to 4.7% in 2012 APBN. For average electricity subsidies consume around 7% of central government spending. This condition shows that electricity subsidies are quite burdensome to the central government budget (Biro Analisa Anggaran dan Pelaksanaan APBN-Sekjen DPR-RI). Problems related to electricity consumed for the national industry gives impact on fluctuations in subsidies and inefficiencies at PT PLN require a comprehensive solution. In implementing the electricity subsidy distribution program that is right on target and foster the performance of PT. PLN in charge, it is necessary to hold a new breakthrough based on technology by creating a systemized system for new registration and re-registration for electricity consumers by bringing the data that has been determined by PT PLN. Next, the consumers will be trained to access the system to determine whether the consumer is eligible for subsidies or not. To overcome the problem the system is proposed the solution through the implementation of Naive Bayes. Based on the result, the system is feasible to categorize for whom the customer get subsidized electricity rate or not. The precise objectives and the system are able to improve the accuracy in selecting consumer tariff subsidy of electricity to the consumer the right target for PT PLN.

## 1. Introduction

In Indonesia, most of the electricity customers categorized as capable households [1]. Problem emerged when electricity rates reached to IDR 1,352,00 / KWH. The proportion of central government spending for electricity subsidies increased from 2.5% in 2005 to 4.7% in 2012 APBN. On average, electricity subsidies consume approximately 7% of central government spending. This condition shows that electricity subsidies are quite burdensome to the central government budget [2].

Electricity plays important role for the society. Based on the 1945 Constitution article 33 said that the state guarantee the wealth for many people. Electricity is important for the community so it require to be regulated and provided by the state. In providing electricity services to the community, the government gives authority to PT Perusahaan Listrik Negara (Persero) to carry out these functions in accordance with Law 19 of 2003. Based on the Law article 66 paragraph 1 regarding Public Service Obligations



(KPU) stated that BUMN in this case PT PLN (Persero) was given a special assignment by the government [3].

Problems on national electricity industry causes an impact on fluctuations in subsidies and inefficiencies at PT PLN require a comprehensive solution. The first and foremost thing that must be done to solve the problem through the implementation of the SLA (Service Level Agreement) by mapping the existing problems [4]. The problems that exist at PT PLN regarding to find the right target in the implementation of electricity subsidies become a solution by proposing the application applied with Naive Bayes method.

Naïve Bayes can performas the fastest and simplest method for payment system. This comes from the Bayes theorem and the freedom hypothesis, producing statistical classifiers based on opportunity. This is a simple technique and able to perform for more complex methods. Naive Bayes classification is a method by matching some data with the cluster process for each data used.

## 2. Literature review

### 2.1. Definition of subsidized electricity rates

In Indonesia, Subsidized electricity rate is a sum of total cost paid by the Government to PT. PLN (Persero), and calculated based on the difference between the cost of for low rate electricity consumed and for basic electricity rate multiplied by the number of kWh used by customers. For maximum limit approximately 30 kWh per month.

Subsidized Electricity policy is expected to preserve for electrical availability for community, preserve for constantly electricity supply, as well as providing opportunities for underprivileged customers and people who have not access for electricity [5].

### 2.2. Definition of Naive Bayes

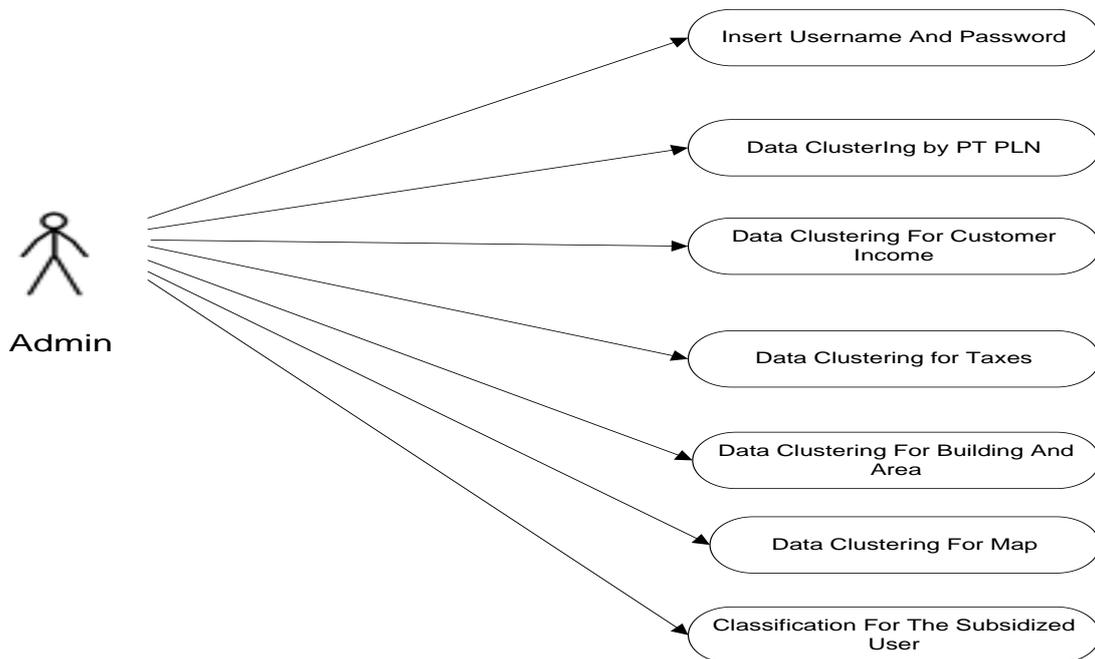
Naive Bayes classification is a classification method taken from Bayes theorem. The main characteristic of Naive Bayes classification are very strong assumptions (naive) would be the independence of each state / event. Before explaining the classification of Naive Bayes, first we will explain the Bayes theorem which is the basis of the method. In Bayes theorem, if there are two separate events (for example A and B), then Bayes theorem is formulated as follows:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)} \quad (1)$$

## 3. Methods

### 3.1. Use case

In order to create the application, the use case diagram can be drawn as follows:

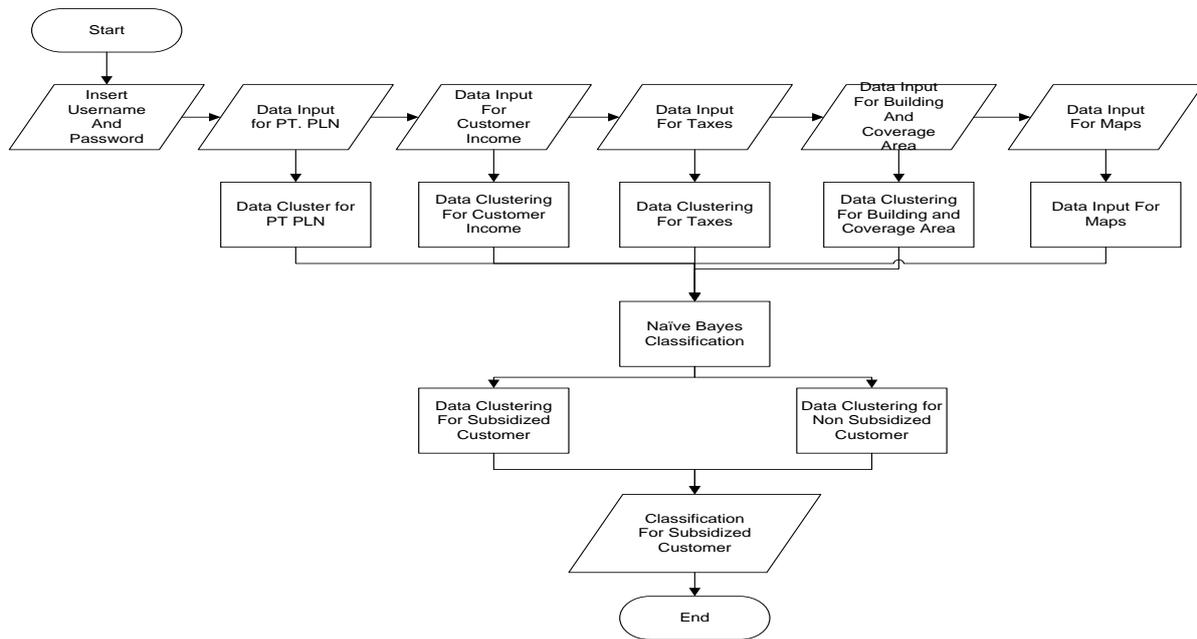


**Figure 1.** Use case diagram.

- Username and Password  
To log in into the system, it requires to insert a username and password for safety, and also it will protect both of the data and the system from hackers.
- Data Cluster PT PLN  
For the initial process, this system will cluster the consumers in advance which whom are use subsidized and non-subsidized rates.
- Tax Data Cluster  
The next process is clustering customer tax data to re-check and match for monthly income tax payments to the electricity rates.
- Salary / Income Data Cluster  
At this part, it can be seen from the types of salary groups received each month whether customer are able or not for paying electricity rates.
- Land Cluster  
This cluster will input data for total land area and building for making decision whether the consumer is eligiblefor subsidized rates or not.
- Cluster Maps  
Cluster Maps serves to monitor that the addresses of customers who submit subsidized rate are correct and match through online Google maps

### 3.2. Flowchart system

From the use case diagram, it can be drawn into the system flowchart as follows:



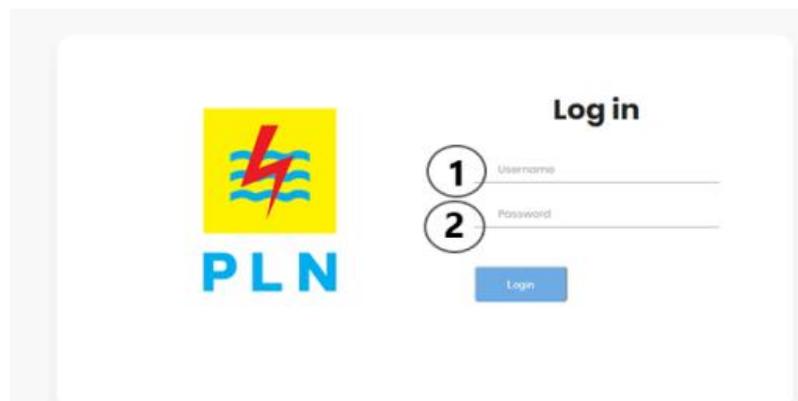
**Figure 2.** Flowchart system.

It can be explained that before being classified using Naive Bayes, the data will be clustered first in each process so that each process will be training data based on the results of the system created.

#### 4. Results

After conducting the analysis and design, the next stage is program testing. By testing the program aims to implement the design that has been made. The results of the implementation are as follows:

##### 4.1. Login



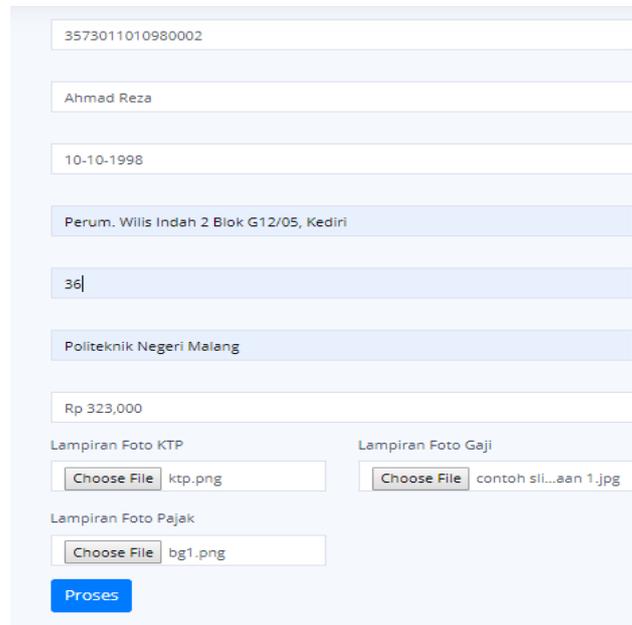
**Figure 3.** Login / Login page.

From the picture, there are two menu forms covers:

- Username, the admin serve to fill the ID customers.
- Passwords, as keys that can use to get access to the system.

#### 4.2. Main page form

After logged in, next is the main page of the application. The interface of the main page will be shown below:



The screenshot shows a web form for entering customer data. The fields are as follows:

- NIK: 3573011010980002
- Nama: Ahmad Reza
- Tanggal Lahir: 10-10-1998
- Alamat: Perum. Willis Indah 2 Blok G12/05, Kediri
- Luas Tanah: 36
- Kategori Luas Tanah: Politeknik Negeri Malang
- Gaji: Rp 323,000
- Lampiran Foto KTP: Choose File ktp.png
- Lampiran Foto Gaji: Choose File contoh sli...aan 1.jpg
- Lampiran Foto Pajak: Choose File bg1.png
- Proses button

**Figure 4.** Data Input for customer.

From the picture above, there is a main page that showed about brief information about the smart use on electricity, so that, the jargon may improve the performance of the admin for working well.

There are 3 tab menus served on the Main Page, namely:

- Check customer data: this menu will open a new form to fill in potential customer data.
- Map: this menu will display map feature.
- Customer Data: this menu will open a list of customers already registered.

#### 4.3. Prospective consumer data form

From the results of the main page above then the next is to enter the Form page for prospective customers in which there are several textboxes that must be filled. The prospective customer form will be shown below:



The screenshot shows the result of the data input form, displaying the following information:

- NIK : 3573011010980002
- Nama : Ahmad Reza
- Tanggal Lahir : 10-10-1998
- Alamat : Perum. Willis Indah 2 Blok G12/05, Kediri
- Luas Tanah :36
- Kategori Luas Tanah :2
- Instansi : Politeknik Negeri Malang
- Gaji : Rp 323,000
- Kategori Gaji :1
- Status : Subsidi
- Simpan button

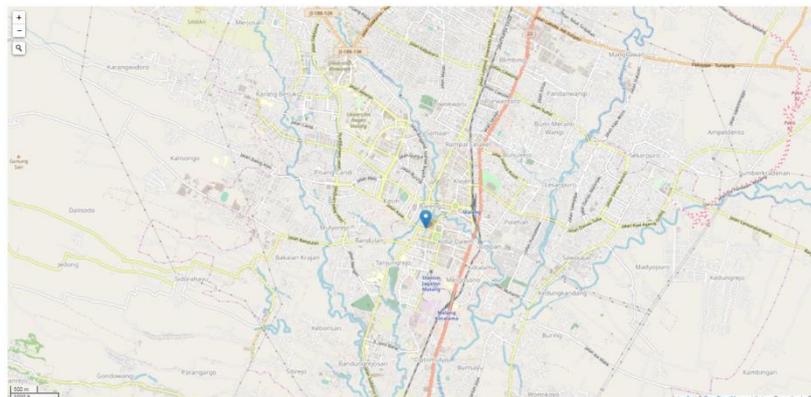
**Figure 5.** Result.

From the picture above it can be seen that many toolboxes and buttons must be filled in and if the process button is pressed then the cluster results will appear as shown below:

Above salary categories and land area categories are 1 or 2 so that customers get subsidies. Then press the Save button to send data to the database.

**4.4. Map**

From the results of customer land area input, next is to Map page for prospective consumers in which there is a map that functions to find the address. To be able to find out the consumer Map as shown below:



**Figure 6.** Map.

**4.5. Customer data**

This menu contains customer data that has been registered in the database. Display customer data is shown as shown below:

PLN HOME MAP CEK DATA PELANGGAN DATA PELANGGAN SELAMAT DATANG, ▾

Tabel Data Pelanggan

Show 10 entries Search:

No	NIK	Nama	Tanggal Lahir	Alamat	Luas Tanah	Instansi	Gaji	Foto	Status	Action
1	3573011010980002	Ahmad Reza	10-10-1998	Perum. Willis Indah 2 Blok G12/05, Kediri	36 m2	Politeknik Negeri Malang	Rp 323,000.-	KTP SLIP PAJAK	Subsidi	Edit Hapus

Showing 1 to 1 of 1 entries Previous 1 Next

**Figure 7.** Result for data customer.

In the column above there are 3 buttons: ID card, SLIP and Tax. These three buttons are used to view photos of KTP, SLIP Salary and Tax from existing customers. Then in the column there is also an Action button which contains the delete and update buttons. The delete button is used to delete existing customer data. Then the update button is used to change existing customer data.

**5. Conclusion**

Based on the results, it can be concluded as follows:

- Based on the results of the manufacture obtained an intelligent system to help determine consumers who get subsidies and non-subsidies right on target.

- This system can improve accuracy in choosing consumers to subsidize electricity rates to targeted consumers.

### References

- [1] Wiharja Y T and Natalia C 2013 Analisis Simulasi Dampak Kenaikan Tarif Dasar Listrik Terhadap Institusi Rumah Tangga di Indonesia dengan Model Computable General Equilibrium *Jurnal Metris* **14**(2) 121-130
- [2] Biro Analisa Anggaran dan Pelaksanaan APBN SETJEN DPR RI 2015 *Kinerja Ekspor Impor Indonesia* (Jakarta: Biro Analisa Anggaran dan Pelaksanaan APBN SETJEN DPR RI)
- [3] Mahpud S 2011 Evaluasi Kritis Terhadap Kebijakan Subsidi Listrik Pada Pt Perusahaan Listrik Negara (Persero) "Critical Evaluation On Electricity Subsidy To The State Electricity Company (PT. PLN)" *Jurnal Widyariset* **14**(1)
- [4] Kementerian Keuangan 2013 *Kajian Efektifitas Penugasan Public Service Obligation (PSO) Kepada Bumn Sektor Energi: Implementasi Performance-Based Regulatory (PBR) Pada PT PLN (Persero)* (Jakarta: Pusat pengelolaan risiko fiskal badan kebijakan fiskal)
- [5] Rosandy T 2017 Perbandingan Metode Naive Bayes Classifier Dengan Metode Decision Tree (C4. 5) Untuk Menganalisa Kelancaran Pembiayaan (Study Kasus: Kspps/Bmt Al-fadhila *Jurnal Teknologi Informasi Magister* **2**(01) 52-62