

Big Data and Artificial Intelligence for E-TOLL



Ayu Ratna Lalitya Sudjana, Elizabeth Husin

Abstract: Commuting in Indonesia, an archipelago country, with its geographic location is quite challenging especially when the infrastructure is not well developed in many suburban areas. Land commuter will have to take the toll road to travel to different areas and it requires e-toll card with enough balance to pay. Mostly, problem occurs when the e-toll card is out of balance while the commuters are still in the middle of the toll road and the e-toll machine is not facilitated to offer top up feature where usually the commuter need to wait and borrow the e-toll card from the next commuter to pay at the toll gate and still more. Therefore, this paper will discuss more on the research to solve this problem. The goal of this research is to utilize Big Data and Artificial Intelligent to facilitate the E-Toll system in Indonesia to become better and hopefully keep improving the e-toll service to all land commuters. With the utilization of Artificial Intelligent ability to do the work and modelling human thought process and Big Data with a diversity of high data sources, it needs to be managed by many methods and assistive devices with an appropriate performance. In addition, it aims to determine the constraints that commuters feel while using automated toll gates especially in suburban areas of Indonesia. Methods of research using Systematic Literature Review (SLR). The results of the research will show the ability of these two things in updating the E-Toll system before into a better version continuously.

Keywords: Big Data, Artificial Intelligent, E-Toll.

I. INTRODUCTION

Traffic congestion is an urban phenomenon, especially in the capital city. The amount of vehicle usage increases annually. As a result, congestion became a routine activity for large townspeople. With Big Data that has a high data source and Artificial Intelligent can model the process-human thought process, of course, it is very interesting if two things can be used to update the existing E-Toll system. E-Toll is an electronic card that is used to pay toll road entrance fees in Indonesia. E-Toll users only need to stick the card to pay for the toll which is faster than paying in cash. The benefit of e-Toll also reduces the operating costs as it only takes costs to

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collect, deposit and transfer cash from the bank system. In addition of being the first step in the modernization of money collection, the use of e-toll is also intended to reduce fraud since the toll officers do not receive direct payment.

II. RELATED WORKS

A. Artificial Intelligence

Artificial Intelligence is part of computer science that learns how to create machines (computers) to do the work like and as well as humans, even better than what humans do. According to John McCarthy, 1956, “AI: To know and model the process – the human thinking process and designing the machine to be able to mimic human behavior” [1].

To create a machine to be intelligent (act like and as good as humans), it must be given the knowledge and have the ability to think. Two main parts are required for artificial intelligence applications:

- A. Knowledge Base: contains facts, theories, thoughts and relationships between one another.
- B. Motor inferences (inference engine): the ability to draw conclusions based on knowledge.

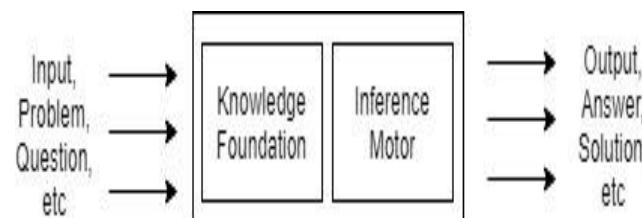


Fig. 1. Artificial Intelligence System [1]

The Advantages of Artificial Intelligence:

1. More permanent. Natural intelligence can change due to the human nature that tends to forget. Artificial intelligence has not changed as long as the computer system and the program does not change it too.
2. Easier to duplicate and deploy. Transferring human knowledge from one person to another requires a very long process and skills that can never be duplicated completely. So if a knowledge is located on a computer system, that knowledge can be copied from a computer and can be moved easily to another computer.
3. Cheaper. Providing a computer service will be easier & cheaper compared to bring someone to work on a number of jobs for a very long period of time.
4. It is consistent and thorough because artificial intelligence is part of computer technology while natural intelligence always fluctuates



5. Can be documented. The decisions made by the computer can be easily documented by tracking each activity of the system. Natural intelligence is very difficult to reproduce.
6. Can work some tasks faster and better than humans.

B. Big Data

Big Data is a technology system that is introduced to tackle the explosion of information in line with the growth of mobile and internet data users [2]. This growth turned out greatly affect the development of volumes and types of data that continue to increase significantly in cyberspace. Various types of data, ranging from data that are texts, images or photos, videos, to other forms of data, flooding the computing system. Surely this needs a way out. And Big Data is a solution that has often been accomplished some time lately, and its appearance is indeed considered a solution from the fact that shows that Data growth over time has exceeded the limits of the ability of both storage and existing system databases.

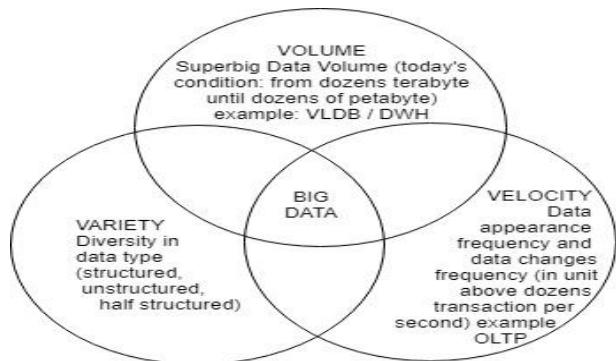


Fig.2. Big Data Relationship [2]

Big data enable us to see again what data that we have, whether there are displaced or neglected data, then we can optimize the data source we have [2].

C. E-Toll

E-Toll is an electronic card that is used to pay toll road entrance fees in Indonesia. E-Toll user only need to stick the card to pay the toll money within 4 seconds, faster than when paying in cash which takes 7 seconds [3]. The use of e-Toll also reduces the operating costs as it only costs you to collect, deposit and transfer cash from your system bank. Besides to be the first step in the modernization of money collection, the use of e-toll is also intended to reduce fraud because the toll officers do not receive direct payment.

E-Toll with integrated RFID (Radio Frequency Identification) system allow to do transaction remotely.

This card was issued by the cooperation of PT Jasa Marga Tbk, PT Citra Marga Nusaphala Persada Tbk, Bank Mandiri, and PT Marga Mandala Sakti. In the early stages (January 2009), this card can only be used in three toll lines namely, Cawang-Tomang-Cengkareng, Cawang-Tanjung Priok-Pluit, and Cikupa-Merak. The plan, this card will be applied for fuel payment at the petrol station and as payment at the rest area of the toll [4].

In June 2017 was also socialized, all transactions at the toll gate using an e-toll that would begin in October 2017, to reduce congestion during the queue and the next step in modernization (simplify and accelerate) payments.

PT Jasa Marga shares the tips of transaction with E-Toll card at the toll gate system:

1. In the entry toll gate, stick your e-Toll card to the card reader.
2. After the e-Toll information appears on a LCD display then automatic lane barrier (ALB) or bar door will open. Pull back the E-Toll card from the reader.
3. Save the card back well for easy when doing the transaction at exit.
4. At the exit, submit the E-Toll card to the officer to assist the transaction and will return the card with the transaction proof.

III. RESEARCH METHOD

A. Design Systems of Big Data and Artificial Intelligent for E-Toll

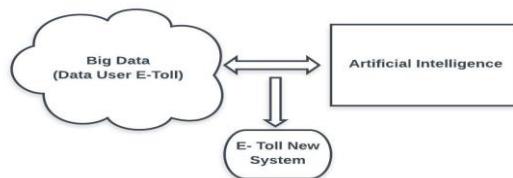


Fig.3. Design systems of Big Data and Artificial Intelligence for E-Toll

By combining the utilization of Big Data and Artificial Intelligence for storing user E-Toll data, this will make a new design E-Toll system. With all the user data will be stored in Big Data, to minimizes the error in transactions and more secure. While Artificial Intelligence facilitates the transaction system in a more practical and efficient way.

IV. RESULTS AND DISCUSSION

A. E-Toll New System

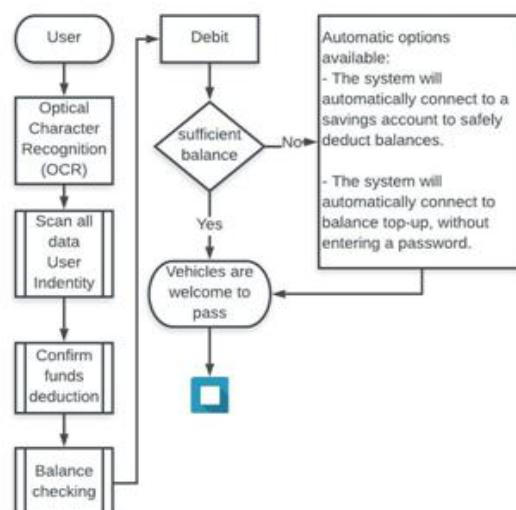


Fig.4. The new E-Toll system design workflow

User will be directly connected to Optical Character Recognition, so there is no cheating or problems related to user data.

- Scan all user identity data, check all data connected to Big Data and Artificial Intelligence.
- Confirm funds deduction, the system confirms the nominal amount of funds to be deducted.
- Balance checking, the system checks whether the user funds are enough.
- Debit, Deducting E-Toll transaction funds.
- Sufficient balance check amount balance.
- If the balance is not enough then the system gives options:
 -The system will automatically connect to the savings account in order to reduce the balance securely.
 -The system will automatically connect to recharge, without entering the password.

B. Application Comparison

The authors make comparisons between the current e-toll and the new e-toll system. The following are the results of research on these 2 systems:

Table 1.1 E-Toll Systems Comparison

E-Toll Features	Current	New
Tap to Pay	Yes	Yes
Top Up E-Toll Card	No	Yes
Linked to Bank Account	No	Yes
Optical Character Recognition	No	Yes
Balance Checking Reminder	No	Yes

V. CONCLUSION

The implementation of Big Data and Artificial Intelligence aims to implement a new system on the old E-Toll system. Where the system is more efficient, secure and more simple to use by e-toll user. After did a deep research, the implementation of E-Toll that implements Big Data and Artificial Intelligence applies to all people who have a savings account in the bank. So, one of the requirements when going to buy E-Toll card is commuters must have an active bank account because it will be connected to E-Toll card. In future, we also hope that Indonesia's infrastructure will be improved so that it can reach all regions and facilitate Indonesian citizens to access toll roads without facing any difficulties to pay.

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