

Conference Paper

Logistics and Supply Chain Engineering: Perspectives on Paperless System for Highway Automatic Tollgate (HAT) through Industry 4.0. in Indonesia

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Abstract

This paper elaborates discourse on Highway Automatic Tollgate (HAT) within logistics and supply chain engineering perspectives. The aforementioned HAT and its implementation are complying with the Product Design Engineering's perspectives within theoretical and industrial implementation through Industry 4.0 in Indonesia. The objective of this paper is to intertwine the theoretical perspectives with industrial implementation. The industrial implementation constitutes the effort to implement paperless system for HAT in order to reduce wasted papers that are necessarily needed by user of this HAT, as transaction proof. The result and discussion of this paper comprise several discussions to be considered. To begin with, the result of this paperless system helps the cleaning service officers to reduce their cleaning duty. Furthermore, the result of this paperless system integrates the concept of industry 4.0 within scope of internet of things (IoT) and internet of everything (IoE). Subsequently, the discussion on this paper refers to the discourse on logistics and supply chain engineering perspectives, to ease the transaction proof involving big data. As a result, it reduces significantly the vehicle traffic and time needed to proceed to transaction in the aforementioned HAT. This paper refers to the research methodology within quantitative approach. As future research, it is indispensable to intertwine both aforementioned theoretical and industrial implementation. Both implementation, as future research, need to be integrated within the Asia Region.

Keywords: Big data analytics; internet of things; making Indonesia 4.0; paperless mechanism; product design engineering

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1. Introduction

Paperless system in Highway Automatic Tollgate (HAT) is expected to integrate the concept of industry 4.0 within scope of internet of things (IoT) and internet of everything (IoE). The mentioned Highway Automatic Tollgate is interchangeably referring to Gardu

Tol Otomatis (GTO); and known as Highway Automatic Gate. The integration of the aforementioned concept is in the full swing, including the implementation of Industry 4.0 in Indonesia. The connected devices within IoT and IoE are integrated among each other, allowing the smooth operational efficiency [1]. The efficiency result has trigger further industrial implementation in Indonesia, not only within global Industry 4.0, but also within Making Indonesia (MI) as Indonesia's Local Wisdom and Settings. Automotive industry is one of prioritized industries to be implemented within the context of MI 4.0 in Indonesia perspective. Its exponential growth within automotive industry has simultaneously triggered significant infrastructure development, including highway construction all across Indonesia. The aforementioned highway is categorized as either a paid highway or an unpaid highway. The unpaid highway is intended for general purpose for vehicle public facility, and the paid highway is intended for fast tract vehicles that required specific highway specifications. The latter paid highway refers to the Highway Automatic Tollgate (HAT).

RFID (Radio Frequency Identification) technology and the payment mechanism through social messenger are escalating in its demand within the highway automatic tollgate [4], including the industrial implementation of GSM technology [5--7]. In addition to the GSM technology, there are escalating demands for technology that is linked directly to the driver database which provides the information of the membership and amount of money [8]. For that phenomenon, the driver requires some forms of payment receipt. Paper as payment receipt is still deemed as very popular in many payment transactions including in the HAT. Similarly, this paper payment receipt is considered popular in Indonesia and is still in high demand within payment transactions [9]. Although the era of e-money has been applied across Indonesia, on the other hand, the transaction proof process still remains a paper structure.

This paper proposes, in its result and discussion, the paperless system of the payment receipt. The paperless system integrates the highway automatic tollgate (HAT) with the mechanism of email or Short Message Services (SMS) of the driver through the Internet [10--12]. Once the driver does the transaction before entering the paid highway, the system will identify the data registered the driver data by the system. The system is then will send the receipt of the transaction to the email or the SMS of the driver through the Internet within Big Data Analytics.

2. Problem Statement

The problem statement of this paper indicates the challenge toward the implementation of the payment receipt. The physical evidence of the payment receipt in HAT is still ubiquitous in almost tollgate across Indonesia. To some extent, the drives do not need the payment receipt in terms of physical evidence.

As a consequence, there are significant wasted papers that are printed for payment receipt; and to be scattered at anytime and anywhere near the highway automatic tollgate. Figure 1 and Figure 2 depict the condition in which the unused received e-toll payment scattered all over the toll gate. Subsequently, the unused received e-toll payment on the autonomous machine is still piling up and attached in a long printed paper on the aforementioned machine of highway automatic tollgate.



Figure 1: The unused received e-toll payment scattered all over the toll gate

3. Research questions

Two significant research questions have been considered in order to enhance the thorough research of this paper. The first research question refers to the question of how to deal with the payment receipt at the highway automatic tollgate (HAT) in



Figure 2: The unused received e-toll payment on the autonomous machine

terms of physical payment receipt. Subsequently, the second research question refers to the question on what are the alternatives as proposed method to reduce the unused physical payment receipt.

4. Purpose of the study

The objective of paper is to intertwine the theoretical perspectives with industrial implementation. The theoretical perspectives refer to the related theory within logistics and supply chain engineering. The industrial implementation constitutes the effort to implement paperless system for HAT in order to reduce wasted papers that are necessarily needed by user of this HAT, as transaction proof.

5. Conceptual models

The conceptual models in this paper refer to the implementation of paperless system for highway automatic tollgate (HAT). Thus, these models are trying to reduce paper waste from the mechanical system within machine in HAT. The mentioned highway automatic tollgate is interchangeably referring to *Gardu Tol Otomatis* (GTO) and known as Highway Automatic Gate. The integration of the aforementioned concept is in the full swing, including the implementation of Industry 4.0 in Indonesia.

Paperless system in highway automatic tollgate (HAT) is expected to integrate the concept of industry 4.0 within scope of internet of things (IoT) and the internet of everything (IoE). Both IoT and IoE involve hardware and software integration. In prior to HAT mechanism, drivers are required to tap the e-money card, and by doing so, the system identifies the drivers' data, which are his/her name, phone number. Those data are connected through system and drivers' email as described in Figure 3.

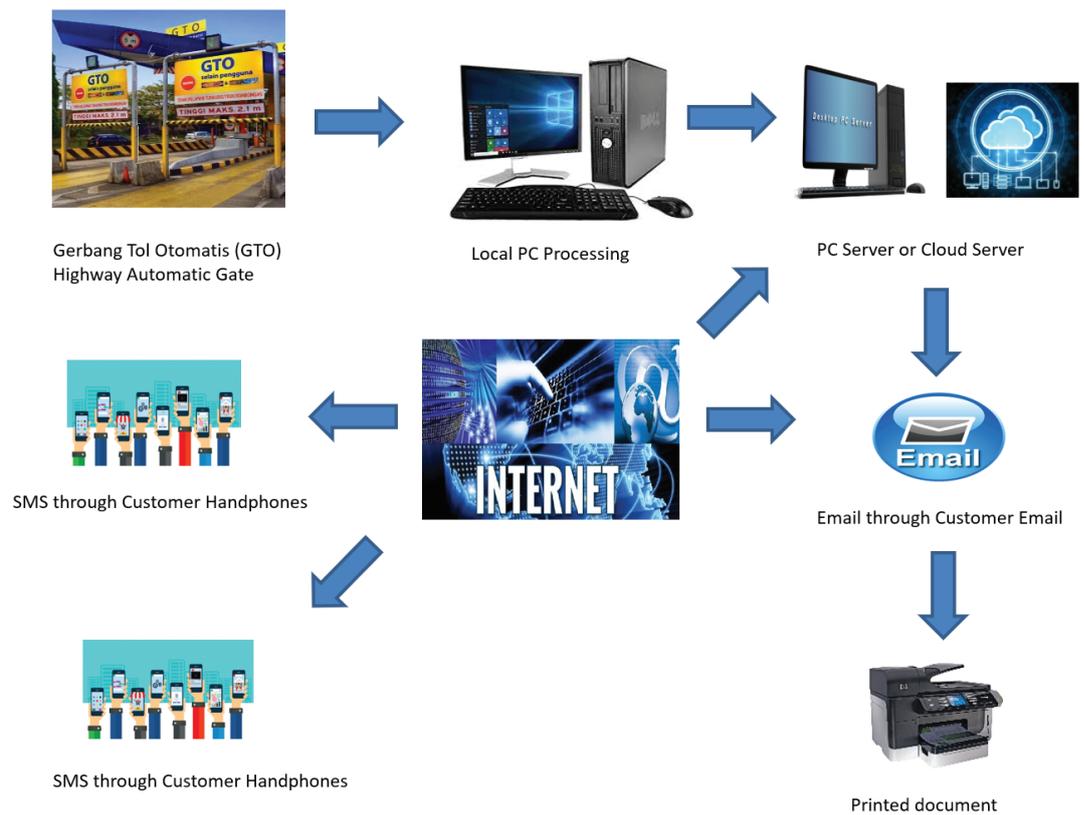


Figure 3: Overall the proposed paperless system for Highway Automatic Tollgate (HAT) payment mechanism.

6. Conclusion

This paper elaborates discourse on highway automatic tollgate (HAT) within logistics and supply chain engineering perspectives. The aforementioned HAT and its implementation are complying with the product design engineering's perspectives within theoretical and industrial implementation through Industry 4.0 in Indonesia. The objective of this paper is to intertwine the theoretical perspectives with industrial implementation. The industrial implementation constitutes the effort to implement paperless system for HAT in order to reduce wasted papers that are necessarily needed by user of this HAT, as transaction proof.

This paper elaborates the unison of results and discussion in terms of paperless systems. This paperless system is enabling cleaning service officers to reduce their cleaning duty. Subsequently, this paperless system integrates the concept of industry 4.0 within scope of internet of things (IoT) and internet of everything (IoE). The result of this paper is enhanced by discussion on this paper. The aforementioned discussion

refers to the discourse on logistics and supply chain engineering perspectives, to ease the transaction proof involving big data.

Indonesia is known as a country with challenging traffic conditions. In addition to that, automotive industry is one of prioritized industries to be implemented within the context of MI 4.0 in Indonesia's perspective. Its exponential growth within automotive industry has simultaneously triggered significant infrastructure development, including highway construction all across Indonesia. The aforementioned highway is categorized as either a paid highway or an unpaid highway. The unpaid highway is intended for general purpose for vehicle public facility, and the paid highway is intended for fast tract vehicles that required specific highway specifications. The latter paid highway refers to the highway automatic tollgate (HAT).

As a result, it reduces significantly the vehicle traffic and time needed to proceed to transaction in the aforementioned HAT. This paper refers to the research methodology within quantitative approach. As future research, it is indispensable to intertwine both aforementioned theoretical and industrial implementation. Both implementation, as future research, need to be integrated within the Asia Region.

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