Android-Based Public Transport Violation Reporting Application

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Abstract. The rise of violations of traffic regulations and standard operating procedures for Batik Solo Trans public transport by public transport drivers is caused by weak law enforcement with limitations of law enforcement officials in its implementation. In this regard, a tool is needed to support law enforcement, particularly in relation to the violation reporting system of the traffic and standard operating procedures for Batik Solo Trans public transport. The reporting tool must be effective, efficient and transparent in its reporting system. The aim of the study is to develop an Android-based public transport violation reporting application called BST Watch App. Android is a Linux-based operating system designed for touch screen mobile devices such as smartphones and tablet computers. Android is an operating system with open source and Google releases the code under the Apache License. The application system is created by using the java programming language. The results of public transport violations characteristic analysis in the study area indicate that the type of violation which is often occurs is picking up and dropping off passengers at outside the bus stop. The implementation of the BST Watch App shows that this application is easy to use, practical, accurate, and transparent.

1. Introduction
Development is something that cannot be avoided by a developing city, as well as the Surakarta city. In a relatively short period of time, the Surakarta city has become one of the locations for various national and international activities. Not only that, various trade and service activities are also thriving, including shops, malls, and hotels. The existence of developments in various fields will have a positive impact on the Surakarta city, especially in the economy. Healthy economic conditions will attract a lot of investment to invest in the city. As a result, the city's income will increase, and the welfare of its residents can be improved. However, in addition to these positive impacts, too massive urban development will have a negative impact on the city environment, especially in the transportation sector [1]. In order to minimize transportation problems, the Government of Surakarta city has a plan to revitalized regular urban public transportation to become public transportation based on Bus Transit system, namely Batik Solo Trans public transport [2]. In 2019, the existence of Batik Solo Trans public transport corridor that has been implemented have 11 corridors, namely corridor 1 to corridor 3 for bus fleets, while corridor 8 to corridor 15 is for feeder fleets [3].

Phenomenon in the field shows that the performance of Batik Solo Trans public transport has decreased from year to year in line with the emergence of new innovations in the transportation sector that change the sustainability of the existing transportation system such as online-based transportation modes, uncontrolled growth in the number of motorized vehicles, traffic and standard operating procedures for Batik Solo Trans public transport violations by public transport drivers. These violations not only make Batik Solo Trans public transport users feel uncomfortable and unsafe so they are reluctant to use public transportation as a mode of travel, but also have the potential to have a negative impact on the safety and smoothness of other road users.
The rise of traffic and standard operating procedures for Batik Solo Trans public transport violations by public transport drivers is caused by weak law enforcement with limitations of law enforcement officials in its implementation both in terms of human resources and systems. In this regard, a tool is needed to support law enforcement, particularly in relation to violations of traffic regulations and standard operating procedures for Batik Solo Trans public transport reporting system. Law enforcement tools must be robust, reliable, easy to use and transparent in the incident recording and reporting system [4, 5]. The development of informatics and communication technology is so fast today, the requirements for this law enforcement system can be achieved by adopting the use of the android system [6, 7, 8, 9, 10, 11].

For this reason, in order to achieve the vision and mission goals of Solo Towards a City with Sustainable Transportation, therefore, the management and engineering traffic especially public transportation services needs to be supported by an integrated and sustainable law enforcement system. In this case, the law enforcement system requires a tool that can be used to record incidents of violations committed by Batik Solo Trans public transport drivers. The evidence of this violation can then be used in the legal process. To achieve this goal, the aim of this study is to develop an application for reporting violations of Batik Solo Trans public transport against traffic regulations and standard operating procedures based on android system.

2. Research Method

2.1. Study Area
The research study area is in the Surakarta city and its surrounding districts where Batik Solo Trans public transport operates. The Batik Solo Trans public transport routes which are the object of the research are as follows:

1. Batik Solo Trans corridor 1 (Terminal Palur – Bandara Adi Soemarmo route): Terminal Palur - Ir. Sutami rd – Kol. Sutarto rd - Urip Sumoharjo rd - Jenderal Sudirman rd - Mayor Sunarya - Kapten Mulyadi rd - Veteran rd - Bhayangkara rd - Dr. Radjiman rd - Dr. Wahidin rd - Brigjend. Slamet Riyadi rd - Adi Soemarmo rd - Terminal Kartosuro - Adi Soemarmo rd - Raya Nogosari Mangu rd – Cendrawasih rd - Bandara Adi Soemarmo.
2. Batik Solo Trans corridor 2 (Terminal Kartosuro – Terminal Palur route): Terminal Kartosuro - Adi Soemarmo rd - Brigjend. Slamet Riyadi rd - Dr. Soetomo rd - Yosodipuro rd - Gajah Mada rd - Monginsidi rd – Kol. Sutarto rd - Ir. Sutami rd - Terminal Palur.
3. Batik Solo Trans corridor 3 (Simpang 3 Kartosuro – Terminal Palur route) Simpang 3 Kartosuro - Slamet Riyadi rd - Dr. Radjiman rd - Bhayangkara rd - Veteran rd - Komodor Yos Sudarso rd - Brigjend. Slamet Riyadi rd - Urip Sumoharjo rd - Kol. Sutarto rd - Ir. Sutami rd - Terminal Palur.

2.2. Research Stages
The study is conducted in several stages. There are developing of the database model for application data storage, user interface design and coding of android application and creating PHP script at web server for interfacing the android application and database server.

Database model is designed within MariaDB [12] database management systems in term of relational database model. The tool uses to create the database model is PHPMyadmin [13], a web-based application for Mysql database management and manipulation. With this tool, a validated user can create, edit and delete objects within a granted database.

The application development is written with Android Studio [14]. It is a perfect Integrated Development Environment (IDE) for developing an android application. This software uses Java language for coding development. It provides facilities such as graphical user interface design tools, libraries for accessing smartphone hardware as well interface for coding development.

The Interaction between android application and database server is required in order the application runs well. A web server must be set online so that users can interactively take data and upload them to the server via the application. The PHP [15] scripts are written with a text editor such as notepad and the uploaded to the server with an FTP program such as WinSCP [16]. In addition, a map library (OpenStreetMap [17]) is required to show the coordinate of an object location in a map perspective.
3. Result and Discussion

3.1. Android Application Development

The Figure 1 shows the user interface of the Android application. The application mainly has two types i.e. user forms and violation reporting forms. The figure 1a shows the main form of the application where a user can proceed further action on the application. The user forms are login and user profile forms (Fig. 1b and 1c). These forms are used to prevent unauthorised user to access the application and to ensure that the stored personal information of a user is valid. The violation reporting forms (Fig. 1d) are reporting and archives forms (Fig. 4). The last two forms are used to record the occurrence of a violation and to view all violation stored in the database. Meanwhile the admin of the systems can access and manage the data via a different web-based application.

![Android Application Screenshots](image)

Figure 1. BST Watch application

3.2. Implementation of Android Application

In order to find out the characteristics of public transportation violations of Batik Solo Trans, therefore, a field survey was conducted. Surveyors are equipped with handphone with the BST Watch application to photograph and record incidents and types of violations committed by Batik Solo Trans public transport drivers. Based on the results of preliminary survey observations, it shows that locations of violations often occur at signalized intersections and bus stops. The poor traffic conditions at signalized intersection indicate that vehicle delays are increasing at the intersection. This triggers Batik Solo Trans public transport driver to violate traffic regulations by breaking through a signalized intersection when traffic light shows a red colour, by driving on a road in the opposite direction to avoid congestion. All of this was done to prevent the travel time becoming too long and reduce vehicle operating costs, see Figure 2a. Another violation which is relate to Batik Solo Trans public transport standard operating procedures, namely by picking up and dropping off passengers at locations other than at Batik Solo Trans public transport stops. This incident often occurs in the service and trade areas such as in traditional markets and places where the bus stops are relatively far from the centre of activity, see Figure 2b and Figure c.
The incidents of violations committed by Batik Solo Trans public transport driver is photographed and recorded by surveyor by using the BST Watch application. Figure 3a shows the incidence of traffic violations photographed by surveyor, then vehicle plate number and description of the violation are recorded. After uploading data, details of Batik Solo Trans public transport vehicle and coordinates location of the violation incident will be recorded (Figure 3b). Figures 3c and 3d shows the incidents of standard operating procedures for Batik Solo Trans public transport violations. All violation incidents recorded by the BST Watch application can be viewed in the BST Violation Report Archives menu. This menu provides a map depicting the location of all violation incidents (see Figure 4).
4. Conclusion
In order to realize Solo Towards a City with Sustainable Transportation, therefore, the Government of Surakarta city provides Batik Solo Trans public transport services. However, in its operation there are still violations committed by some Batik Solo Trans drivers. To anticipate this, a violation reporting system of traffic and standard operating procedures for Batik Solo Trans public transport is needed. This research has developed an Android-based public transport violation reporting application called BST Watch App. The results of the field survey show that the type of violation that often occurs is picking up and dropping off passengers at outside the bus stop. The application is easy to use, can be carried anywhere, practical, conditions and locations of incidents are recorded accurately so that the violation reporting system is transparent.

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