Online transportation surveillance system for improving driving behaviour

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ABSTRACT

Traffic is a problem in every nation. Indonesia is one of the most populous countries in Indonesia, certainly has such one of the biggest problems in the world, especially in big cities such as Jakarta. This is mostly contributed by the number of vehicles in Jakarta. Combine with current trends of Online transportation; the problem is getting bigger. Online transportation is on the rise in Indonesia. Sometimes seen as providing more benefits to people of Indonesia, online transportation also has its side-effects. As the number of online transportations rises, so is the level of traffic in big cities such as Jakarta. This traffic is also getting worse due to the bad driving behavior of Indonesian people, especially the online transportation driver. To better relieve traffic, a system to improve the drivers’ behavior can be developed to ensure safety, increasing driving behavior awareness, and hopefully decrease the traffic problem as a whole.

Keywords: Online Transportation, Driving Behavior, Driving Surveillance, Transportation Surveillance System

1. INTRODUCTION

Jakarta is a big city with many interconnected networks of roads. Just like any other big city in the world, traffic congestion is one of the many problems that exist in Jakarta (1). Looking at the current traffic system, some solutions from researches done in other parts of the world can be proposed to solve traffic congestions in Jakarta (2-4). In Jakarta itself, there was a vehicle high-occupancy policy called 3-in-1 applied a few years ago, but currently, it has been uplifted, resulting in increased traffic congestion (5).

Online transportations in Indonesia have been on the rise since 2016 (6). Brands such as GO-JEK, Grab, and Uber is popular among people in Jakarta (7). Online transportation services are popular due to their flexibility, efficiency, and affordability, among many other factors. These online transportation services utilize owners’ vehicles and allow customers to rent their services to get into places. One of the many services that are available to customers is renting a car-based online transport service. Cars are considered as a high occupancy vehicle (HOV), meaning they can contain more than one passenger at a time.

The researchers are trying to find out whether the use of online transportation services has any effect on the traffic congestion in Jakarta and how to solve them.
2. **ONLINE TRANSPORTATION IN JAKARTA**

This research will be about how online transportation affects traffic congestion in Jakarta and how to solve them, as there seems to be no previous research according to the title of this research. Obviously, Jakarta is one of the most populated cities compared to any other cities abroad and in broad. The population in Jakarta Reached 2,428 people with 16th place of the most populous city in the world after among others are Mumbai, Calcutta (India), Lagos (Nigeria), Shenzhen (China) and any other cities, certainly has an impact on the convenience of the residents (8). This made traffic congestion a severe problem in Jakarta because the number of private vehicle users is increasing 6.3% annually that outgrew the growth of roadways (1). Level of congestion in the city of Jakarta has increased times two during 1985-2000 with a potential loss of 65 trillion rupiahs in 2020, because of unbalanced growth as mentioned above, that is the use of private vehicles and the infrastructure causing longer travel times in almost all roads in Jakarta (1).

Online transportation is a new way of optimizing transportation other than public transportation. A public transportation service project that is being rampant is the modernization of traditional public transport services using IT, known as an online transport service (8). Gojek and Grab as the most popular transportation service have over 500,000 users in 2017 based on play store unique users (9). Moreover, that is only on Android devices. So, we can know that the number of drivers is exceeded the ideal boundary. From that number, it creates sudden traffic congestion (10).

On the bright side, online transportation helps people commute easier, get food more accessible, and sending packet faster (11). On the other side, online transportation success results in decreasing taxi customers (12). That is why it creates a war between online transportation drivers and taxi drivers because online transportation operates on taxi zones (13).

3. **DRIVING BEHAVIORS AND SURVEILLANCE EFFECTS IN JAKARTA**

Driver behaviors in Indonesia are reaching a point where it is making up traffic problems, causing traffic accidents that leads to traffic congestions. Factors that are causing this are fatigue and sleepiness, lack of experience, unfamiliarity with terrain, deficient technical skills, lack of concentration, and other factors that can be categorized into human errors (14). These driving behaviors caused major road accidents to increase at an alarming rate, which causes traffic congestions upon the scene. In 2015, there are 27,000 people died because of the accident, mostly are motorcycles, and over the last few years, it has also been increasing at an alarming rate (14). By these accidents as well, a conclusion can be taken that most of these accidents with the cause factors, also produce traffic congestions and are caused by bad driving behaviors and habits as mentioned above in Indonesia, especially Jakarta.

Characteristics of drivers on the road relating to accidents show that it happens mostly on novice/newbie drivers (14). In order to reduce traffic congestions, drivers must implement good consistent driving behaviors that will affect all of the events that happen on roadways and railways, reaching fewer traffic congestions.
Drivers tend to be obedient in the enforcement area. The problem with the enforcement area is the lack of officers (workforce). Therefore drivers will misbehave after passed the enforcement area (15). However, with a surveillance camera, drivers will always be on guard 24/7, resulting in good driving behavior. Surveillance is no longer confined to law enforcement authorities, or army as it can be found everywhere in our daily life, including on the roads (16).

4. CRITICS AND PROPOSED IDEA

Online transportation is not something that guarantees to be helpful in relating to traffic congestion. The reason for this is that traffic congestion is affected by many factors, while the significant factor that is causing it is the bad driving skills that not just online transportation drivers have, but most likely all road users in Indonesia. This can be proven by the numbers of fatal and severe-injury accidents in Indonesia's traffic, as the numbers keep increasing steadily over the last few years that is caused by several factors, including the lack of driving education (17).

Therefore, this can be fixed by applying driving lessons that are compulsory while making the driving license, and to be more cautious so that bribes can be reduced in the process. Those things must be applied as a significant and vital thing so that they can stick as a character to the driver. As we can see in abroad countries, countries that tend to have reduced numbers of fatal injuries and accidents inroads are usually countries that paid lots of attention to educating drivers so that they have good driving behaviors and characters, in any kind of vehicle that is available.

4.1. SOFTWARE DESIGN

4.1.1. Android:

Android is currently the most used mobile operating system in Indonesia, according to a survey by Statista (18). This is also true to what online transportation driver use every day, as Android-based smartphone is generally cheaper than IOS devices. This affordability of Android devices makes it more accessible to the online transportation driver. This popularity of Android is a significant reason for developing the proposed system. The proposed system will work starting on Android version KitKat 4.4 and up to Oreo 8.1.

![Diagram](image-url)

**Fig. 1. Use Case of Proposed Mobile Application**
4.1.2. Application:

Our mobile application is only meant as a prototype, where it can connect to the Arduino system that is installed on motorcycles via Bluetooth. When the app is connected to the Arduino, then the driver will be allowed to take orders from the customer. If the app is not connected to Arduino, then the driver is not allowed to take orders.

![Activity Diagram of Connecting Device to Arduino](image)

4.1.3. Arduino:

Arduino system will turn on automatically when the driver starts the engine of the motorcycle. Arduino will turn on the Bluetooth module and emit the id of the system. Then Arduino waits for a proper connection to be made. The system does not start recording until a connection is made. This system also connects to a micro SD card as a storage solution. When a proper connection is made, the system will store the id of the driver and start recording. The recording will stop when the device is not connected and will render the driver to be unable to take orders from the server.

4.2. Hardware Design

4.2.1. Arduino Uno Rev3:

Arduino Uno Rev3 is very versatile and easy to develop with, as it has the complete documentation. The Arduino will be connected to the Bluetooth HC-05 module along with the OV7670 Camera Module. The power source will be the battery of the motorcycle.

We chose the Arduino platform because it is open-source, with lots of documentation, an instruction presented in many forums and websites. Arduino Uno board runs on the little amount of power, only requiring a minimum of 7 volts and 12 volts at maximum, according to its documentation. (19)

Arduino can be programmed by using Arduino Sketches with a language using the C programming language.
4.2.2. Bluetooth HC-05:

Bluetooth HC-05 is very popular among other Arduino creators. This Bluetooth module is not only reasonably cheap but also capable of communicating with PC and mobile devices. The HC-05 has two working modes: Data mode in which it can transfer data to and from other Bluetooth gadgets, and AT Command mode where the default settings can be changed. We can switch between both two modes by utilizing the key pin, which is the rightmost pin.

HC-05 module can communicate with others with microcontrollers since it works utilizing the Serial Port Protocol (SPP). It requires +5V power, and the data connection is achieved by connecting the Rx pin of the module to the Tx of MCU and Tx pin to Rx of MCU.

4.2.3. OV7670 Camera Module:

Other creators widely use this camera module and also very cheap. The module operates at low voltage, perfect for this system. It is also manually configurable and can reach up to 30 frames per second. The camera module will be connected to the Arduino as a power source and grounding, and to the Bluetooth module in order to transfer the video feed coming from the camera to the Android application. In order to operate the camera needs 3.3 volts coming into the VCC pin from a power source. In order to communicate with other modules, Tx and Rx cables are connected to another microcontroller unit.
4.2.4. Rubicon Case:

To ensure safety and ruggedness, we use Rubicon case for protecting our set. This case is not only compact but also waterproof. Its design is also modular and modifiable, so we can customize it as much as we can to support this project. Rubicon supports glands to handles cables outside of the Arduino to the camera module. Rubicon is made of sturdy materials such as aluminum steel plates and stainless-steel screws to prevent rust from occurring.

4.2.5. LM2596 Power Regulator:

Connecting the Arduino board directly to the battery of a motorcycle can be dangerous. Due to the unpredictable nature of many types of battery found on the streets, and to make sure just the right amount of power is delivered correctly to the board, we suggest having a power regulator to filter the power coming from the battery. This power regulator will also be responsible for stepping down the voltage to prevent overvolting the Arduino board.
4.3. Assembly

In order to make the hardware, we will connect the Arduino, Bluetooth and camera module such as in this schematic below.

![Example schematic to build the hardware](image)

The black line is the ground line, and the red line is power cable running from the Arduino board to supply both modules with needed power. The camera module needs 3.3 volts total while the Bluetooth module will require 5 volts. In order to allow data transfer, the Tx pin of the Bluetooth module will be connected to Camera Tx pin, and the Rx pin of Bluetooth module will be connected to the Rx pin of the camera module. These pins colored with blue and yellow cables will be responsible for data transfer. After constructing the Arduino, we will upload some code programs into the memory of Arduino, where it will interact together with the Bluetooth module and the camera.

Not shown in the schematic above is our power source. The motorcycle battery will power our Arduino by pulling a 12 volts output from the battery. In order to better supply clean power to our Arduino, we will use a voltage regulator.

After the program is uploaded and we can turn on the Bluetooth module and program it to change its name and then we are finished with the Arduino set.

Our Arduino set is encased in a Rubicon metal casing completely waterproof to prevent the hardware from being damaged by the weather and any danger presented by the road.

4.4. Installation

![Example of Arduino set installation](image)
In order to install our Arduino set, we will first find for empty openings in the front of the motorcycle to place the Arduino. If there are not any possible installation location, then there need to be small modifications. While in most motorcycles, the front of it will be empty and most of the time has space for such a small camera that we use. If modifications are not possible (which will be in the rare case) as the driver uses sport/naked type of motorcycles which requires us to make some holdings for the camera, or if it is not possible, then the installation would be on the speedometer of the motorcycle.

After being correctly installed, the driver will have to connect the application into the camera via Bluetooth. The camera will be instantly running when the volts required are given into the power, which means that nothing is needed to set up anything in the camera or motorcycle. The process will be simple, just like connecting into an audio device in a car. After everything is connected correctly, then the driver will be available to take orders.

The video feed is then transferred into the device to store the data of the video feed. When the video feed is terminated, then the driver will not be able to take orders anymore. Then when the driver every month must come to the office to submit their videos.

The purpose of the placement of the camera is so that the driving behavior of the driver can be monitored through the submitted videos, as it will determine their driving behavior score. If the score reaches below the limit, then the driver will not be able to take orders, hence will be suspended for at least one week as the company’s partner. However, the driver can still work for the company on conditions; the driver has to take driving behavior educations managed by the company, after the suspension time given is over. Then the company will determine whether the driver is qualified to get back to the street or not, by the test scores which the test will also be given on the educations.

5. CONCLUSION

Solving the big problem if traffic in big cities is a hard one to solve. Especially with the rise of online transportation, more vehicles are drawn to enter the already busy traffic giving more traffic. Sometimes the cause of traffic problems can be a behavioral one rather than technical ones. In this case, we are trying to solve how notoriously famous behaviors of online drivers in Jakarta may commit more to the traffic jam problem. By doing a monitor on how drivers drive, we try to evaluate how they are doing on the streets. This monitoring system can hopefully provide some psychological burden to suppress lousy driving behavior. Giving the online drivers a psychological reminder that their driving behavior is monitored, we hope that drivers will become more thoughtful of how they drive around in traffic.

Reference:


