

Development of Variable Instrument Template for Collecting Dashcam Footage

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ABSTRACT – *Installing a dashboard camera or dashcam on a vehicle brings many benefits and advantages. The device functions as a closed-circuit CCTV camera to record activities on the road. The rapid development of dashcam technology has inspired researchers to highlight a study that uses dashcam videos to determine road accident status. Based on the researcher's understanding, many of these accidents happened in the blind spot area of the vehicles. However, conducting the analysis based on the uploaded accident footage is not easy because the downloaded footage is raw and needs to be assessed in terms of quality and validity. Therefore, this study will focus on developing the criteria for analyzing dashcam footage so that the developed template can be used as the minimum variables that need to be focused on to extract information from the accident footage. The existence of dashcam footage has provided researchers the opportunity to investigate actual events when an accident occurred. This scenario offers an opportunity for many parties to understand the causes of the accidents and play a role according to their respective expertise to prevent fatal accidents on the road. It is hoped that with the production of a valid and proven instrument template for analyzing dashcam videos, many researchers will be motivated to do more related studies.*

KEYWORDS: Dashcam, road safety, Malaysia

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1. INTRODUCTION

A dashboard camera or dashcam is a camera installed in a vehicle to record images and sound while driving. The device functions as a closed-circuit CCTV camera to record activities on the road. Dashcams are available in three types: (1) those produced by car manufacturers that are ready to be installed on a vehicle in the factory; (2) those available in the market and are installed on a vehicle; and (3) those that can be downloaded as an application and installed in a vehicle's computer system. The availability of dashcams has increased the uploading of accident footage on social media. As a population of social media viewers pioneered by young people (Vingilis et al., 2017), the behavior of sharing footage on social media has become a phenomenon.

When dashcam owners are involved in a collision activity, their excitement to share their video recordings is prompted by various motivations. Among the reasons is to voluntarily help the victim of an accident by providing evidence without hoping for a reward, though some individuals would expect some monetary return (Kim et al., 2020). Other individuals are excited to upload footages that have the potential to go viral as a means to educate the community as one form of preaching, and in fact, many do so for instant popularity. One man's ends will always justify his means.

Table 1 enlists the traffic offenses stated in the Transportation Act 1987 (Law of Malaysia, 2006). The offenses include exceeding the speed limit, as well as driving recklessly and dangerously (whether or not causing death); if convicted, the drivers committing these offenses may be fined or imprisoned according to the rate and period stated in the Act. Intentionally driving without care and consideration is also an offense, let alone driving in a state of insanity due to being under the influence of alcohol or drugs.

TABLE 1: Traffic offenses and their legal actions at a minimum rate

No.	Traffic Offence	Legal Actions [Fine/imprisonment]
1	Exceeding speed limit	Can be fined not exceeding RM1,000.
2	Driving recklessly and dangerously, causing death	Imprisonment of not less than 2 years and not more than 10 years and a fine of not less than RM5,000 and not more than RM20,000.
3	Driving recklessly and dangerously	Imprisonment of not more than 5 years and a fine of not less than RM5000 and not more than RM15,000.
4	Driving recklessly and inconsiderately	A fine of not less than RM4,000 and not more than RM10,000 can also be imprisoned for a period not exceeding 12 years.
5	Driving while under the influence of drugs or alcohol	Causing death or injury to any person, imprisonment for a period of not less than 3 years and not more than 10 years, and a fine of not less than RM8,000 and not more than RM10,000.

If an accident occurs on the road, the offenses committed above are difficult to prove without evidentiary support obtainable from a dashcam. Before the availability of this technology, investigations of road accidents were prolonged due to the conflicting information by witnesses with different self-interests; they either wished to save themselves from being convicted or to secure evidence for insurance claims.

1.1 Dashcam as a Vehicle's 'Black Box'

The installation of a dashcam on a vehicle brings about many benefits and advantages. The device can increase protection (whether physically or emotionally). During an accident, the vehicle owner, either as the dashcam owner or the eyewitness, could assist the authorities (by sharing their video recording) during the investigation process without distorting the facts or the chronology of events. Therefore, it is not surprising that many Malaysians highly support the use of dashcams for every vehicle as they believe that the use of this device could make every driver drive more prudently and obey traffic rules, due to the awareness that a CCTV can be anywhere on the road (Tamrin, 2022).

Other than facilitating accident investigation, dashcams have been found in previous studies to be useful for investigating collisions involving a driver (who owns a dashcam) with wild animals (Rea et al., 2018). This kind of accident happens when a driver drives in a rural area, or outside development areas. When such an event takes place, the vehicle involved might be severely damaged due to the collision with a larger animal; the dashcam in this case, serves as the black box that can be analyzed, akin to an air crash investigation (planes and helicopters), to find out what had happened before the accident.

Dashcam is no longer a luxury device but a necessity for all road users. The increase in the supply and demand of dashcams has been reported in many scientific studies (Kim et al., 2020), as stated in the work of Adamová (2020). According to Adamová, recorded accident footage can show the real situation when the accident happened. Other than detecting the speed of a vehicle (to see the traffic offense), factors contributing to road accidents can also be identified easily (Ariffin et al., 2021). Falsification of facts and manipulation of real situations can be avoided, and the investigation process can be completed sooner. This situation at the same time makes insurance claims easier and more transparent (Kim et al., 2020).

1.3 Dashcam Video as an Evidentiary Material in Court

The effectiveness of dashcam footage as evidentiary material in legal investigations can no longer be denied, so much so that it has become an important piece of evidence in the United Kingdom (Lallie, 2020). It is reported that the enforcement agencies in the United Kingdom have prepared an official platform online to facilitate their citizens to upload footage that can be used as evidence in the investigation of criminal cases to be managed by law enforcement. According to Associate Professor Dr. Muzaffar Syah Mallow from Universiti Sains Islam Malaysia (USIM), based on Section 3 (c) of the Communication Act 1950 [Act 56] dashcam footage can be categorized as documents in the form of information written as 'any sound recording, or any electronic recording....' and can be used as evidentiary material to support a claim in the trial process of a court case, if proven valid (MSTAR, 2022).

Though the Malaysian enforcers have not provided an official or specific platform, the rapid development of information delivery on social media has made citizens' channels and enforcement boundless. The former can directly connect with enforcement agencies through social media; dashcam footage can be uploaded easily; and enforcement agencies can be 'called' for attention. Currently, Malaysian netizens have become increasingly efficient in carrying out their "duties" by reporting sensational current issues. This matter will indirectly assist the enforcement agencies as if their eyes and ears are everywhere and reports that were initially personal become the case for serious legal action.

The increasing use of dashcams in Malaysia has made it easy for the enforcers to carry out their duties. In fact, the Department of Traffic Enforcement and Investigation (JSPT) of the Royal Malaysia Police (PDRM) has opened support for the people's initiatives to upload dashcam footage that went viral on social media as investigation material when it involves offenders on the road. Figure 1 is one of many examples of how enforcement officers in Malaysia welcome people's complaints through footage recorded from dashcams. With the help of footages that clearly display the vehicle or offender's information, investigations, and legal actions can be taken at a fast pace.



FIGURE 1: Screenshots of information sharing from enforcement social media accounts

The rapid development of dashcam technology has inspired researchers to highlight a study that uses dashcam footage to find out the status of road accidents. The intention is to investigate collision incidents between a vehicle and a motorcycle as obtained from dashcam recordings. The main concern for the current study is accidents that happened in the blind spot areas. However, most of the downloaded dashcam footage is raw and needs to be assessed in terms of quality and validity. Further analysis needs to be carried out based on the criteria that need to be seen. This study, therefore, will focus on the development of the criteria for analyzing dashcam footage to answer the questions hence achieving the overall research objectives.

2. METHOD OF VARIABLE TEMPLATE INSTRUMENT DEVELOPMENT FOR DATA COLLECTION

The dashcam footage obtained from social media is available in various quality and durations. Some of the footages are damaged due to loss of image sharpness or the use of poor-quality recording devices. To ensure that a downloaded dashcam video can be analyzed and derive useful information in fulfilling the research objectives, the variables based on the information extractable from the video must be identified. Therefore, a variable draft needs to be developed. As in other studies, the validity of a research instrument is crucial, and therefore, in this study, the validity of the research instrument – the variables draft template – needs to be confirmed. Once confirmed to be valid, the instrument can be used as a data collection template. This testing process is performed until the instrument or template is stable, i.e. until no modification is required. Figure 2 illustrates the development process of the variables for collecting data from a dashcam video, simplified in a flowchart.

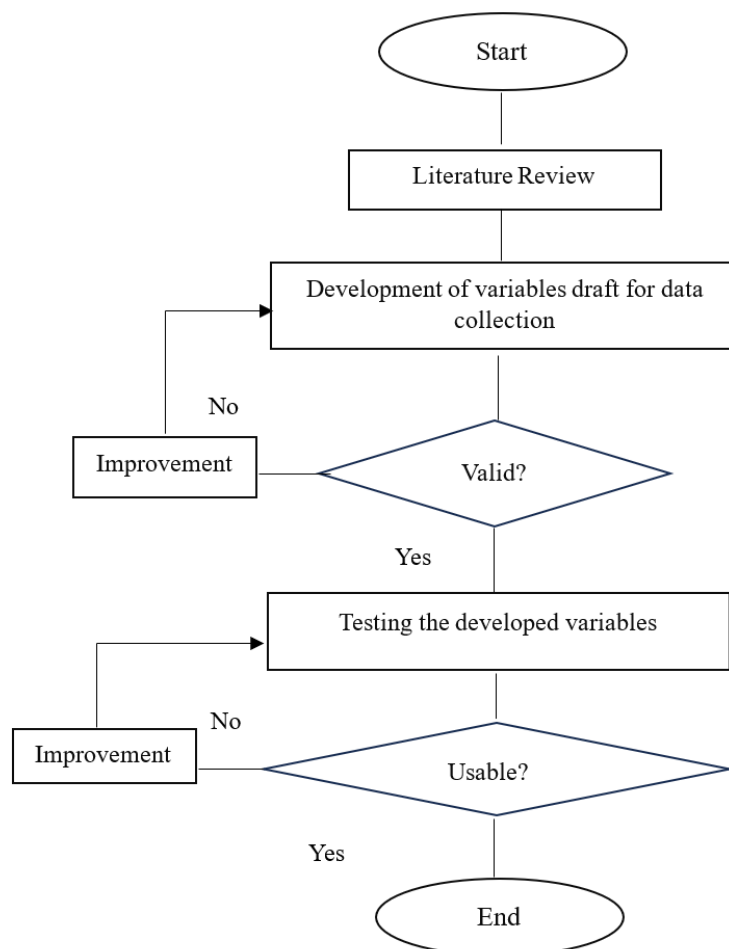


FIGURE 2: Development process of variables instrument template for data collection

3. FINDINGS AND DISCUSSION

3.1 Literature Review

A literature review was conducted to identify previous studies that reported road accidents particularly those involving collisions with motorcycles. One of the studies reviewed was the work of Rolison et al. (2018) on factors contributing to road accidents in the United Kingdom. In the study, 77 police officers were trained to be survey respondents to provide feedback on six road accident footages related to the factors contributing to the accidents. Other than involving experienced police officers, this study also trained 102 residents with licenses and driving experience to get feedback on the factors that had caused the 6 accidents. From the study, many factors contributing to accidents were gathered and became the basis for the development of an instrument template for collecting data from dashcam footage.

In Malaysia, the development of a variable instrument template for collecting data from dashcam footage also involved considering the factors identified from a previous study, specifically the work of Ariffin et al. (2021). Ariffin et al. (2021) downloaded 100 footages from the net and then classified their findings into two categories – road accidents and near-miss accidents – which are an excellent turning point prompting further research on the matter. The findings of Ariffin et al. (2021) also enabled several factors contributing to road accidents and near-miss accidents to be listed.

3.2 Development of Variable Draft for Data Collection

3.2.1 Selection of Platform for Searching Dashcam Footages

The statistical data indicates that the use of social media among Malaysian users in January 2022 was as many as 30.25 million users. This number is expected to increase every year. The four main platforms used were YouTube, Facebook, Instagram, and TikTok. Figure 3 shows the distribution of the use of various social media platforms. These four platforms have become sources where dashcam footages are downloaded for research purposes.

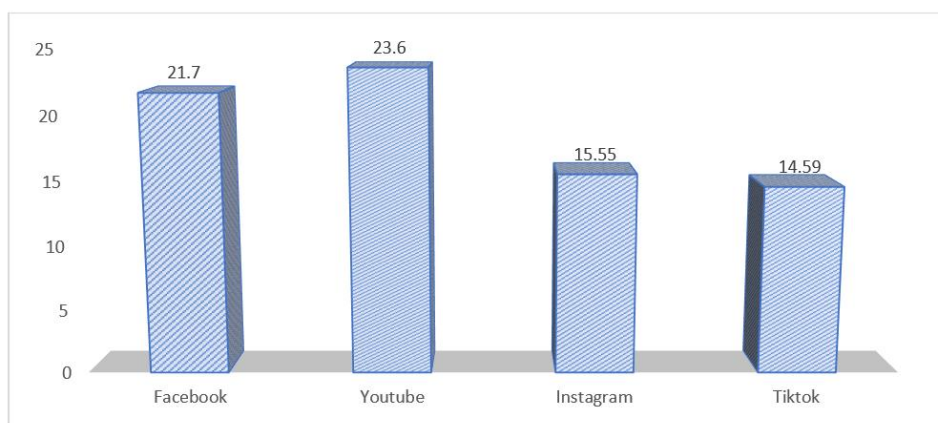


FIGURE 3: Users of various social media platforms in January 2022 (in millions)
(Source: <https://datareportal.com/reports/digital-2022-malaysia>)

3.2.2 Development of Variables and Their Subcategories

The variables and their subcategories for the instrument template were developed in a focused group discussion among the researchers. As many as six researchers were involved. After the draft instrument was developed, a list of variables and their subcategories was presented to two traffic accident investigators who have more than ten years of experience for them to test the validity of the instrument. Improvements were made based on their feedback and suggestions. Then, the instrument draft was presented in a special session (presentation of the project's progress report) attended by road accident researchers from various higher education institutions and research centers. Their feedback was again recorded, and the instrument was further improved.

After the researchers were confident of the validity of the developed template, they began analyzing the dashcam footage that had been downloaded. At least five footages were chosen randomly for the analysis. Along the process of testing the instrument's usability, a few improvements were made. The testing continued until the template was in a stable state.

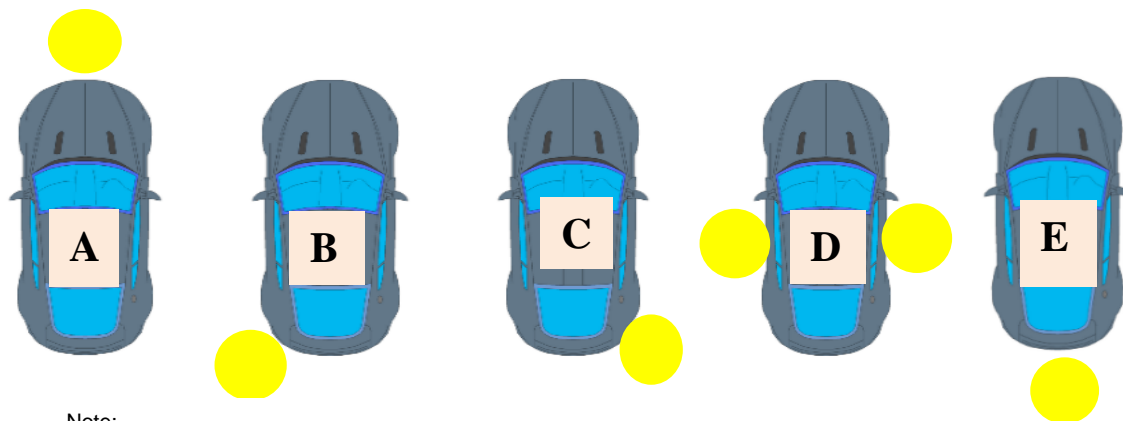
The process of testing the usability of the instrument template must be done carefully for the data analysis to proceed smoothly and lessen the risk of missing important information throughout the process. Table 2 shows the final instrument template that has undergone the validity and usability process and therefore, is ready to be used for analyzing dashcam footage.

TABLE 2: Final instrument template for the variables and sub-variables for dashcam video analysis

No.	Variable	Sub-variable	
1	Gender of motorcycle rider	<ul style="list-style-type: none"> • Male • Female 	
2	Vehicle involved (collided with motorcycle)	<ul style="list-style-type: none"> • Car/Sedan • SUV • MPV/Van • 4x4 	<ul style="list-style-type: none"> • Lorry • Bus • NA
3	Vehicle make involved (collided with motorcycle) (manufacturer)	<ul style="list-style-type: none"> • (various makes) 	
4	Use of helmet (motorcycle rider)	<ul style="list-style-type: none"> • Wearing a helmet • Not wearing a helmet 	
5	Characteristics of rider	<ul style="list-style-type: none"> • Riding in a straight line • Right/left turn • U-turn • Wrong side of the road 	<ul style="list-style-type: none"> • Sudden stop/stop • Not in the appropriate lane • Extreme cornering
6	Rider's behavior	<ul style="list-style-type: none"> • Normal riding • Crossing the street • Running a red light 	<ul style="list-style-type: none"> • Lane changing • Crossing over the centerline • Action inappropriate skill
7	Lighting condition	<ul style="list-style-type: none"> • Daylight • Night with streetlight • Night without streetlight • Cloudy • Tunnel with light 	
8	Weather	<ul style="list-style-type: none"> • Fine • Raining 	
9	Road condition	<ul style="list-style-type: none"> • Dry • Wet 	
10	The event that took place (based on observations)	<ul style="list-style-type: none"> • Rider - Not injured • Rider - Injured • Rider - Badly injured / dead • Rider - Confirm dead 	
11	Accident location	<ul style="list-style-type: none"> • Urban • Rural 	
12	Motorcycle rider before accident	<ul style="list-style-type: none"> • Brake (tried to avoid before the collision, and fell) • No brake (motorcyclist falls or is thrown due to a collision) 	
13	Severity of accident	<ul style="list-style-type: none"> • Rider not injured • Rider injured • Rider was badly injured/dead • Rider confirmed dead 	

3.2.3 Development of Variables to Determine the Collision Area between Motorcycle and Vehicle

Previous studies have shown that many casualties among motorcycle riders were due to a collision in the blind spot area of the vehicle involved (Kamaru Zaman et al. 2020). This necessitates the development of specific variables to record the collision areas, which consist of a few sub-variables (Table 3). Five sub-variables were developed to record the area where the motorcycles collided or were hit by a vehicle. As shown in Figure 4, A is a sub-variable when a motorcycle collides in front of a vehicle; B, when a motorcycle collides at the end of the left side of the front or rear of the vehicle; C, when a motorcycle collides in the front or rear right side area; D, when a motorcycle collides on the left or right side of the vehicle; and E, the motorcycle collides behind the vehicle involved. If the dashcam recordings of these collisions can be analyzed well, a distribution of the collision areas can be reported, and further actions can be taken to identify improvement measures to reduce the rate of road accidents, particularly those involving motorcycles and a vehicle's blind spot.



Note:
A: motorcycle rider crashed at the front of the vehicle
B: motorcycle rider crashed at the rear-left of the vehicle
C: motorcycle rider crashed at the rear-right of the vehicle
D: motorcycle rider crashed at the side (left or right) of the vehicle
E: motorcycle rider crashed at the rear of the vehicle

FIGURE 4: Sub-variables of collision areas between motorcycle and vehicle involved

Many efforts have been taken by the authorities to ensure that road accidents, which have been heavily discussed in media and digital interfaces, can be controlled to the minimum. Traffic and road safety rules must always be revised, and enforcement must also be constantly carried out to sustain drivers' awareness of self-safety while contributing to a safe ecosystem when operating their respective vehicles. The rapid economic growth has contributed to increasing the nation's 'purchasing power'. The increasing number of drivers who passed their driving tests is also an indicator of the people's ability to remain competitive, i.e. that is, having the capital to earn a household income, thus making the road a 'bread-and-butter' battleground. Hence, safe roads need to be realized by pooling the energy and resources from all parties.

A responsible citizen must check the validity of every information obtained from social media. Fake information that can lead to confusion and anxiety can threaten peacefulness. Video modification and falsification of images in dashcam footage during forensic analysis is a debated issue among researchers (Kim et al., 2020). Forgery of video and digital images with the various tools available online for free has resulted in the issue becoming increasingly critical and inconvenient for various parties. Authentic information then becomes difficult to identify using the ability of the human eye (Ahmad & Khursheed, 2021). If the information obtained is valid, one angle that needs to be attended to is the need to respect individual's rights. This issue has been strongly debated because it could lead to trauma and other emotional disorders hence mental problems (Beyari, 2023). This issue will not be discussed in this paper but will be highlighted in future publications.

In Malaysia, forgery of information related to traffic rules is a crime, regardless of the purpose of the act. Table 3 enlists the related Acts that can be convicted regarding the falsification of the matter discussed. However, with the rapid growth of artificial intelligence (AI) technology, the threat of the crime

of forgery of digital content is becoming more worrying. Though the technology offers many advantages, it also opens up opportunities for cybercrimes to become more prevalent when this technology is controlled by irresponsible individuals. Therefore, it has become a shared responsibility to explore more widely the branches of AI science to find a way to deal with this problem by enacting more relevant laws.

TABLE 3: Acts related to forgery of the source of information and the consequences of a conviction

No.	Act	Excerpts from the Act and the Consequences of Violating the Act
1	Road Transport Act 1987 (Containing all amendments until 1 July 2006) (Law of Malaysia, 2006)	<p>...make any entry in a record, register, certificate or other document required to be issued, kept, maintained or given that is false or misleading in any material respect</p> <p>Upon conviction, can be fined not exceeding RM5000 or imprisoned for a period not exceeding one year or both.</p>
2	Communication and Multimedia Act Malaysia 1988 (Law of Malaysia, 1998)	<p>.... using the content application service, may provide content that is objectionable, obscene, false, threatening or obscene in nature with the intention of disturbing, abusing, threatening or harassing any person.</p> <p>If convicted, can be fined not more than RM 50 000 or imprisoned for a period not exceeding one year or both and can also be fined one thousand ringgits for every day or part of a day the offense continues after conviction.</p>

4. CONCLUSION

In conclusion, dashcams have been an indicator of technological advancement that has made Malaysia flooded with video footage. With CCTV on every surface of the road, Malaysians have become more civil when maneuvering their respective vehicles. Welcoming the relationship between law enforcement and the people who are concerned about the harmony of the country, Malaysian citizens who wish to make any report related to a traffic offense, particularly with dashcam footage, must ensure complete information as follows:

- i. Visible (clear) vehicle registration number
- ii. Color of vehicle
- iii. Type of vehicle

It is hoped that the high awareness of the authenticity and quality of footage can help law enforcement carry out their duties to protect the country, and cyber crimes attempting to damage the Malaysian legal ecosystem can be curbed. Dashcam video issues and privacy rights, trauma cases as victims, and the connection between trauma cases and mental illness need to be further refined. In short, many tasks are still unfinished. Scholars, politicians, and national scientists, including law enforcers, need to move forward together to become a stronghold of the latest technological development (AI) so that it does not become a threat to life, rather it becomes a trigger for the betterment of road safety.

The existence of dashcam footage has provided researchers the opportunity to investigate actual events when an accident occurred. This scenario offers an opportunity for many parties to understand the causes of the accidents and play a role according to their respective expertise to prevent fatal accidents on the road. It is hoped that with the production of a valid and proven instrument template for analyzing dashcam footage, many researchers will be motivated to join the cause by conducting more related studies.

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