# OBSERVING ROAD-KILL INCIDENT IN JELI AREA BY UTILIZING THE ANDROID APPLICATION

**By**

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## DECLARATION

I declare that this thesis entitled "Observing Road-kill Incident in Jeli Area by Utilizing the Android Application" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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**APPROVAL**

"I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Applied Science (Natural Resources Science) with Honors"

Signature : …….....

Name of Supervisor :

Date :……..

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**OBSERVING ROAD-KILL INCIDENTS IN JELI AREA BY UTILIZING ANDROID APPLICATION**

## ABSTRACT

There are a lot of road-kill incident witnessed by civilians around the Jeli area but the incident were not recorded and analyze properly. Therefore, this research is conducted to properly record the road-kill incidents using android application named *Roadkill* developed Spotteron, in Jeli area. The survey was carried out twice a day, for four days. The morning session starts from 8-11 a.m. and continued at 4-7 p.m for every session. Two types of road were chosen which are highway Jeli-Gerik and local road in Jeli area with the total distance around was 30 km. The area of study was divide into 4 parts; A, B, C and D. Survey in the morning took place from area A to area B while in the evening took place from area A to area C and D. Parameter recorded during the survey were type of road, location, time, and type of animals. A total of 21 road-kill incident cases were recorded with 33% mammals, 33% reptiles, 23% birds and the rest was from amphibians. This project can help to introduce the usefulness of Android application in surveying road-kill incident especially in Jeli area for mitigation and monitoring purposes.

**PENINJAUAN KES PELANGGARAN HAIWAN DI JALAN RAYA DALAM DAERAH JELI DENGAN MENGGUNAKAN APLIKASI ANDROID**

## ABSTRAK

Terdapat banyak kejadian kemalangan haiwan di jalanraya yang disaksikan oleh orang awam di sekitar kawasan Jeli tetapi kejadian tersebut tidak direkodkan dan dianalisis dengan sepatutnya. Oleh itu, kajian ini dijalankan untuk merekodkan kejadian tersebut dengan betul menggunakan aplikasi android yang dinamakan *Roadkill* yang dibangunkan Spotteron, di kawasan Jeli. Kajian itu dijalankan dua kali sehari, selama empat hari. Sesi pagi bermula dari 8-11 pagi dan diteruskan pada 4-7 petang. Dua jenis jalan yang dipilih ialah jalan besar Jeli-Gerik dan jalan kampung di kawasan Jeli dengan jumlah jarak sekitar 30 km. Kawasan kajian dibahagikan kepada 4 bahagian; A, B, C dan D. Tinjauan di pagi hari berlaku dari kawasan A ke kawasan B manakala pada waktu malam berlaku dari kawasan A ke kawasan C dan D. Parameter yang direkodkan semasa tinjauan adalah jenis jalan, lokasi, masa, dan jenis haiwan. Sebanyak 21 kes direkodkan dengan 33% mamalia, 33% reptilia, 23% burung dan selebihnya adalah dari amfibia. Projek ini dapat membantu memperkenalkan kegunaan aplikasi Android dalam meninjau kejadian pelanggaran haiwan di jalan raya terutama di kawasan Jeli untuk tujuan mitigasi dan pemantauan.

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**LIST OF SYMBOLS**

| | |
|---|---|
| Km | Kilometer |

## LIST OF ABBREVIATIONS

| | |
|---|---|
| a.m | Ante meridiem |
| p.m | Post meridiem |
| etc | etcetera |
| Dr | Doctor |
| WROS | Wildlife Road-kill Observation System |
| PERHILITAN | Department of Wildlife and National Parks |

# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Study

Impacts of streets or roads on biodiversity are associated with the death of animals. Throughout the development of a road, several incidents that include death from collision with vehicles (road-kill, modification in animal behavior), could happen (Tombulak and Frissel, 2000). Wildlife road-kill caused mortality and injury of wildlife ensuing from collision with a moving car or any other vehicle on the road. It happens as a result of wildlife and human driving automobiles are on the road at the same time, and cannot anticipate the behaviour of one another. Wildlife appeared on the roads for many reasons and becomes the victim to road-kill as an outcome of many factors (Zoë, 2004). The factors embody animals are attracted by grass, bushes and water in margin ditches, which might typically stay well in weather condition and season, once very little food or water is obtainable elsewhere (Mooney & Spencer, 2000). Food thrown out of vehicles (Drews, 1995) and present animal dead bodies resulted from road-kill (Forman & Alexander, 1998) also attract wildlife to come to the road. Roads are also used as socializing territory (Case, 1978), and as main accessibility to new spaces for the young generation of the animals (Van der Zande *et al.* 1980). Animals are usually appeared on roads merely through the act of crossing to the opposite facet. They will cross the roads to achieve access to water, crop and pasture as

well as territories, hence, in some other countries, crossing roads is a component of a daily route for a few animals. Aquatic animals like platypuses and fresh crayfish are often killed on Australian state streets after they cross over the surface of the road to avoid travel through culverts beneath the road (Mooney & Spencer, 2000).

Animal-vehicle collisions are an oversized and growing concern among the public drivers, conservation organizations and agencies, and thus Departments of Transportation (DOT). (Huijser *et al.* 2009). Animal-vehicle collision could be an assurance matters for drivers (Bissonette *et al.* 2008) and a conservation concern for many animal species (Fahrig & Rytwinski, 2009). Loss *et al.* (2014) estimated that in one year, 89 to 34 million birds may die in United States due to collision with vehicle. Department of Transportation in many countries are attempting completely relevant strategies of minimizing animal-vehicle collision, together with fencing roadways and providing crossing structures across the right-of-way to permit safe animal passage. Animal-vehicle collision happens once traffic coincides with an area wherever animals attempt to cross the surface of a route. Anticipating and highlighting these places for lessen the impacts to drivers itself and animals may be a vital step in reducing the conflict. To notify these varieties of forecasting and corresponding mitigation at an outsized scale, it becomes necessary to gather correct, extensive, semipermanent animal-vehicle collision knowledge.

In 2007, Government of Malaysia has provided financial support to complete three wildlife underpass viaducts that would offer linkages ecologically significant corridors in northeast Malaysia. These linkages are connecting National Park, Kenyir Wildlife Corridor in Terengganu, and other forest in the north area of Malaysia.

These three crossing structures are meant to produce property for giant mammals like the elephant, sun bear, tiger, perissodactyl mammal and etc. Although the initial Environmental Impact Assessment (EIA) had recommended fences to mitigate impacts on life, yet, Department of Wildlife and National Parks (PERHILITAN) insisted that the viaducts were necessary together with a realignment of the road additional off from the National Park boundaries to limit access for poachers (Quintero, 2010). It was reported that a total 32 important species of wildlife found in this area. Some of the species that utilize the underpass includes elephant, Malayan Tapir and Barking Deer (Clements *et al.* 2012).

Van der Ree *et al*. (2011) argued that the study on larger view extents and population level may bring road ecology to the next level. Huge amount of datasets gathered from big study areas help the study to be more details. The results of the continuing road-kill observance project in European country support the conclusion that gathering a lot of records of road-kills and systematic observance of road-kills with scientists, expedited by tools like smartphones deliver huge information and take road-kill observation to a whole new level.

In Malaysia, the government is about to build additional viaducts and roll out life crossing awareness at driving faculties after recording more than two thousands road-kill cases over 5 years. However, a system to collects and records the data of the road-kill yet to be developed and are needed to ensure the efficiency of the mitigation measures that will be created in the future.

## 1.2 Problem Statement

There are a lot of road-kill incident witnessed by civilians around the Jeli area but the incidents were not recorded and analyze properly. This is because the lack of awareness among people on the importance of analyzing road-kill. In respond to this, this research is conducted to properly record the road-kill incidents, in Jeli area.

## 1.3 Objective

The objective of this project is:

1. To observe the road-kill incident based on type of road, location and time by using *Roadkill Application.*

## 1.4 Scope of Study

The main focus of this study is to analyze the report animal-vehicle collision incident in Jeli area. In the meantime, the study also can help us to create a new road-kill mitigation measures specifically for that species in that certain area.

## 1.5 Significant of Study

This project can help to introduce the usefulness of Android application in surveying road-kill incident, not only in Kelantan but also for in a global scale. This application can be used to record observations from reporters out in the field who come across identifiable road-killed animals. Every Malaysian can use this application to help government and related organizations in collecting and recording the data of the road-kill. The advantages of this study are people can save a lot of money and time, as well as increase the accuracy of detecting the accident location.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Overview of Wildlife Road-kill Observation System (WROS)

There are 4 main ways in which observations might be recorded: (a) involvements of past records of road-kills incidents or dead bodies that preceded the web-based system; (b) form-based coverage on an internet site, together with drop-down menus; (c) assistance of cellphone application web-systems; and (d) social medias, like Twitter and Facebook. This project is included in the third way. Until recently, very little analysis has been handled on the data gathered by this sort of comes, however a few terribly encouraging research are printed in last few years (Snäll *et al.* 2011; Sardà-Palomera *et al.* 2012).

Analysis to determine non-random bunches of multiple or single species animal-vehicle collision's hotspots commonly used a Geographic Information Systems (GIS); a promising device wherever statistics are used to determine spacial clusters. Examples of analytical approaches and methods include: 'Satscan', inspired by the continuous research, which focused for fixed bunches of events (Ball *et al.* 2008); Nearest Neighbor Index (Matos *et al.* 2012); the Getis-Ord- Gi statistic for spatial autocor-relation (Getis and Ord 1992); as well as the Kernel Density Estimator Plus formula that could be used in estimating locations of high densities of road-kill events.

Monitoring and investigation variety roots of changes in variety permits the public to create choices concerning conservation (Wilson, 1999; Devictor *et al.*

2010; Bang and Faeth 2011; Corona *et al.* 2011) and enhance conduct of human-animal problems.

Volunteer-science brings an oversized and sturdy group of spirited individuals inquisitive about problem-solving and knowledge assortment. Moreover, volunteer-science has expedited the research of ecological processes operational at broad spacial and temporal scales, so much on the far side the traditional field studies limit (Wilson *et al.* 2013). Some of the biggest observation of wildlife systems within the world rely totally on volunteer's hardwork to establish trustworthy, verified life knowledge (Schmeller *et al.* 2009; Ryder *et al.* 2010). These volunteers are usually skilled biologists creating wildlife observations in their leisure hour and tributary these observations to varied wildlife reportage systems (Cooper *et al*. 2014). The example of the system is California Road-kill Observation System (CROS). People always think about volunteer science collected information is that they will have to face the surveyer unfairness and identification error (Cooper *et al.* 2014). Nonetheless, this has not always been the problem, and error also are outweighed by the dimensions of datasets on the market from volunteers (Schmeller *et al.* 2009; Ryder *et al.* 2010). It is foreseen that data combination can turn into a ton of productive and institutionalized, as the volunteer science development ends up partner exchange. With the volunteer man of science benefitting as much as possible from the data that they require helped advance in an extremely logical field they are enthusiastic about. Informatics may be a practise that gives means, helpful to gather, handle, and apply various sorts of information to support analysis and management. Conservation-oriented study of ecological knowledge collected in standardized web-based information

processing systems by volunteers could be a crucial part of feedback to volunteers and might be an efficient way to use the data (Fraser and David 2015).

There are 3 spatial scales of road-kill mitigation: the length of road, an entire region or state, and last but not least, the black spots. A black spot is a short area of street wherever a few individual creatures are murdered or wherever individuals of a types of intrigue are killed (Zoë *et al*. 2004). Regardless of the abstraction scale at that the mitigation is used, there are two fundamental types of road-kill mitigation measure: changing driver action and changing life attitude.

## 2.2 Application and Advantages

The applications and blessings of the road-kill watching information gathered by national scientists are a lot. A couple of essential ones for meandering records and transect information are recorded independently beneath.

In a studies carried out by Snäll *et al*. in (2011), a stratified list of the most liable species is drawn based on each traditional watching of transects by researchers and subject science comes supported roving records. However, the latter supply the chance to continue the watching with comparatively several suggests that for several years and observes the changes within the list. This can be an indecent method of observing species myriad. For example, in a study, stone marten (*Martes foina*) was considered the 9$^{th}$ most frequently reported victim and red fox (*Vulpes vulpes*) was ranked the 3$^{rd}$, while each weren't even within the top 10 of road-kills throughout a previous study that was conducted in 1995, the total of road victims parallels their come

back to several components of Flanders become higher (Van Den Berge *et al*. 2009). From these informations, the occasional patterns in numbers of road-kill per species emerge.

Many authors focus the significance of itinerant records as a filling knowledge supply for observance the distribution of rare species (Snäll *et al*. 2011; Sardà- Palomera *et al.* (2012). The huge amount of data and information accumulated in public's science projects ends up in a higher chance to find new and rare species. George *et al*. (2011) said that this way, "the dead can also be used to monitor the living". To be more precise, this can improve distribution maps of the events discovered (George *et al*. 2011). New species also can be disclosed by doing road-kills monitoring (Auliya, 2002; Covaciu-Marcov *et al*. 2012).

By doing this way of observing and recording for years, the connectivity issues between road-kill hotspots and landscape can be recognized not just along a few trajectories observed by researchers, but also along most roads in a bigger scale of project area.

Hence, if the data is made public, many road managers and government are going able to take proof primarily based mitigation actions (Sardà-Palomera *et al*. 2012). Meandering records were utilized to screen and model species circulations. The next action is to estimate road-kill hotspots related to species on and road-kill observation knowledge together with Species Distribution Models (SDM).

# CHAPTER 3

# MATERIAL AND METHOD

## 3.1 Study Area

The study was conducted in District of Jeli, Kelantan. The main location in detecting road kill accidents in this study was on the road selected on Jeli-Gerik Highway and local roads in Jeli which covered a total distance of 30 km. Besides highway, this study also carried out on the local road with smaller size of road compared to the highway road. Figure 3.1 showed the location of the study area.

The total distance of Jeli-Gerik Highway is 124 km with 61 km situated in Perak and the rest are located in Kelantan state. The highway make the journey from West to East, and vice versa, become easier and faster, thus improving the economy not only in Perak and Kelantan states, but also the economy of the whole country.

Due to its hilly nature, this East-West Highway is one of the more scenic routes in Peninsular Malaysia. The highway passes through Bintang Mountain Range and Titiwangsa Range. Forested area were still intact on the right and left side of the highway with high biodiversity of flora and fauna. There are places where drivers are warned to be caution with wildlife or animal that cross the road which mostly initiated by the PERHILITAN. Signs are place up to warn highway users of elephants, tapir and any big mammals crossing the road, as there is no green corridor were built for the animal cross the road.

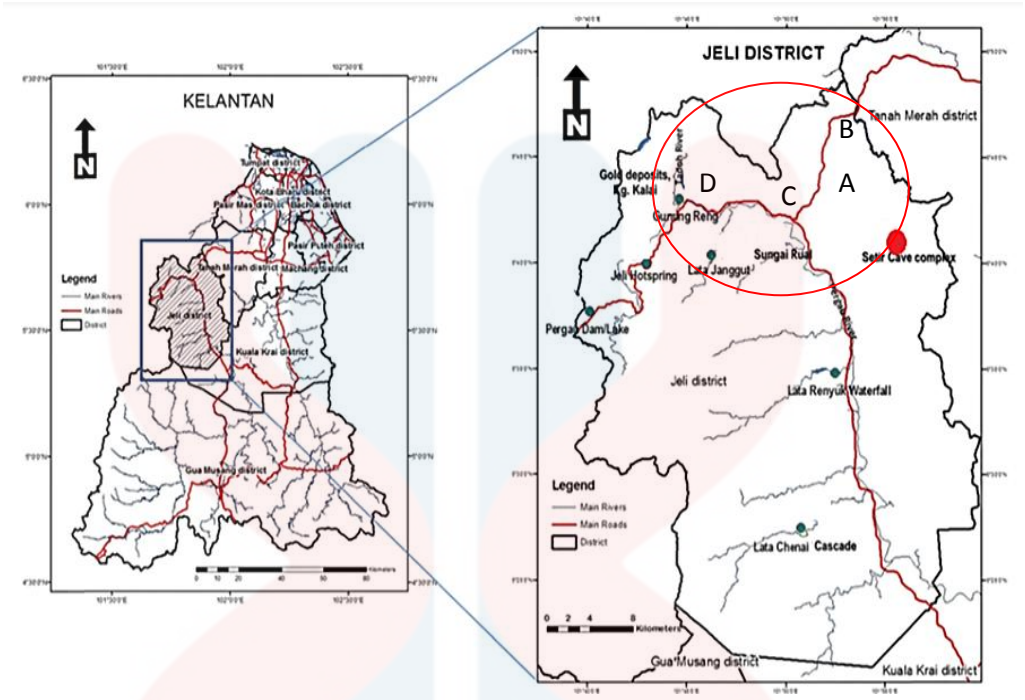


**Figure 3.1**: Location of study area in Jeli District

(map source: ArcGIS, 2018)

## 3.2 Material

The material uses in this research are the android application named *Roadkill* (Figure 3.2) and detection of the dead body of the animals that was found along the local road and highway. The application was developed by a company named Spotteron by Dr. Florian Heigl, from Austria. With this application ones can participate in a scientific road-kill project with the aim to reduce road-kill. We can also examine which animals are killed on roads and which factors are influencing road-kills. The data allows us to identify road-kill hotspots. In this study, the number of road kill cases (animal dead body), time, location and picture were recorded using this application. Further, the data and map of road-kill incidents could be downloaded in excel form for further analysis.

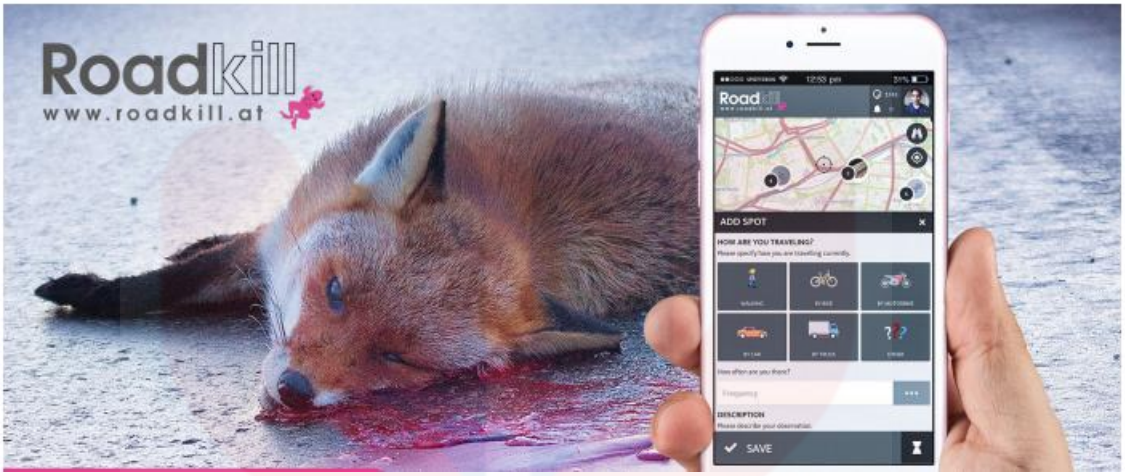


**Figure 3.2**: Roadkill application developed by Spotteron (Spotteron, 2018)

## 3.3 Method

### 3.3.1 Data Collection

The main method of data collection is by survey the highway and local road plotted as Figure 3.1. By riding a bike, the surveys were conducted twice a day. The morning survey was started from 8.00 to 11.00 a.m. while for evening survey it was continued from 4.00 to 7.00 p.m everyday. This study was done in four days.

The areas of study was divided into 4 parts; A, B, C and D (see Figure 3.1). Survey in the morning took place from A-B roads, while in the evening survey started from point A-C-D. The parameter recorded for road-kill include type of road (highway or local road), location (where the dead body of the animal was found), time (morning or evening) and date as well as types of animal involved.

# CHAPTER 4

## RESULTS AND DISCUSSION

Based on our survey, a total of 21 road-kill incident cases were detected and recorded. Figure 4.1 shows the distribution of road-kill cases based on animal types or carcasses found on the road. The average road-kill in Jeli based on the result is 7 cases per day. 66% of the victims of road-kills in this study were mammals (e.g. monkey, cat and bat). While the least found animals were amphibian, frogs with 10%.

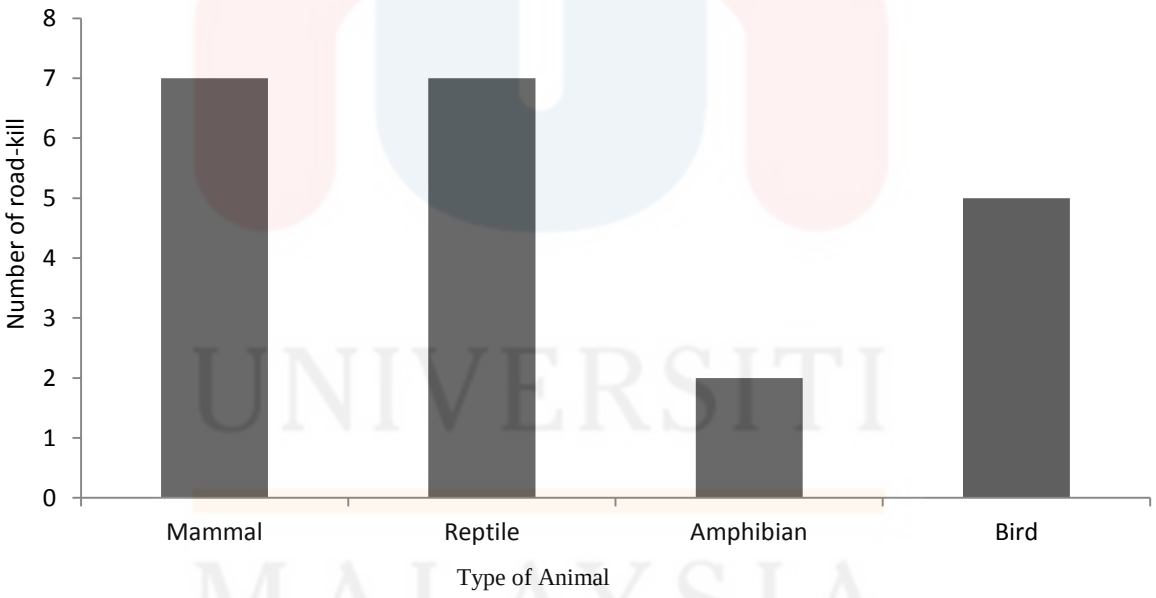


**Figure 4.1**: Number of individuals road-kill recorded based on animal type

The frequency of road-kill incident was different different road types. It was found that major road kill incident happen on the highway road compared to local road as

shown in Figure 4.2. The highway that act as a connector between Kelantan and Perak resulting the road to be used by a lot of vehicles. Hence, Figure 4.3 shows the number of cases happen in different period of time (morning or evening). From this survey, 71 percent of the road-kill incidents were detected in the evening. This is due to the high traffic density that was caused by people who were going back home after the office ended usually at 5 in the evening. In this time also, the animals started to go back to their nest as the day gradually become darker.

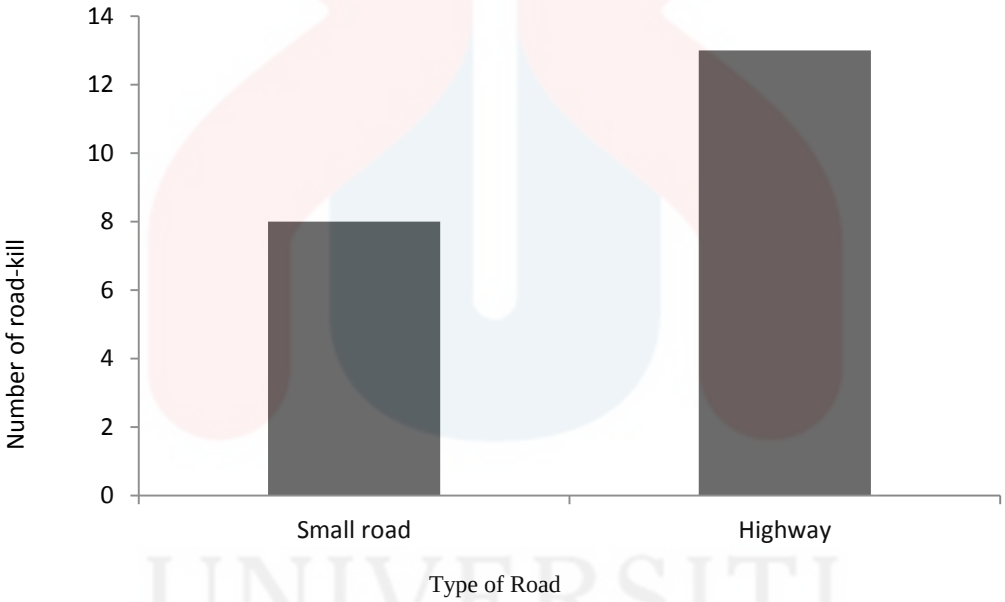


**Figure 4.2**: Road-kill incident happen in different road type in Jeli

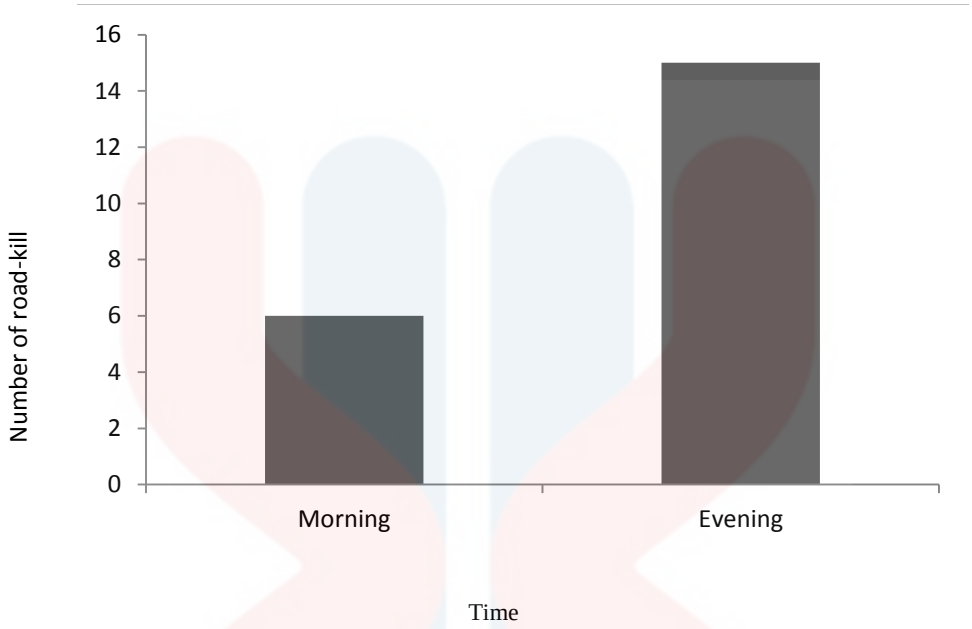


**Figure 4.3**: Numbers of Road-kill incident in different time frame

The distribution of detected road-kill was also plotted in the map by *Roadkill Apps* as shown in Figure 4.4.

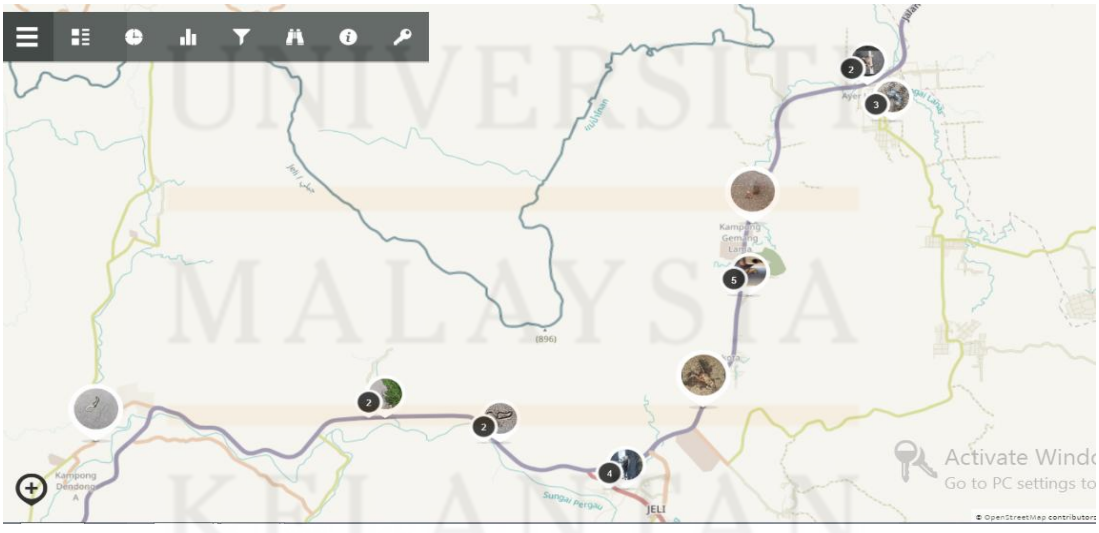

**Figure 4.4**: The distribution of detected road kill incident at the study area plotted by *Roadkill Apps*, Spotteron (Spotteron, 2018)

From the data, it can be concluded that animal on highway road either wildlife or domestics are more exposed to the risk of getting involved in road-kill than in the small countryside road. It is because the traffic density in highway is greater than local road, therefore the risk of animal-vehicle collision become higher. The difference between maximum speed limit of these two different types of road can also be the factor of this study outcome. Highway have speed limit for 80-90km/h, that were fixed by the Minister of Works (MOW), certainly can be more dangerous for animal to cross the road than the local roads which has only 50-60km/h speed limit (MOW, 2016).

There are also a lot of forests nearby the highway making the vehicle more vulnerable to encounter wildlife from the forest. Mammals, recorded the highest frequency of road-kill in this study. This was expected due to urbanization that grows drastically in Jeli area, especially near the highway. Cat (*Felis catus)* is usually kept by human as pets. This make the cat is counted as a domestic animal. The high breeding rate of cat, as mentioned by Abigail. (2016), make the population of the species become abundance in the domestic area. It is unsurprising that there were cat roaming along the highway and commonly involved in the road-kill.

The low number of amphibians in the result is expected due to the far distance between aquatic ecosystem and the study area. They inhabit a variety type of habitats, with most species living inside terrestrial, fossorial, arboreal or fresh aquatic ecosystems. Even so, the majority of the amphibians still live freshwater ecosystems (Diego *et al*, 2005).

The example of road-kill incidents were as in Figure 4.5 that showed a cat that has been ran over by vehicle, while Figure 4.6 showed a snake that has been ran over by vehicle in Jeli.

**Figure 4.5**: Cat that has been ran over by vehicle in Jeli

**Figure 4.6**: Snake that has been ran over by vehicle in Jeli

# CHAPTER 5

# CONCLUSION AND RECOMMENDATIONS

## 5.1 Conclusion

The observation of road-kill incidents in Jeli area had been successfully carried out by using *Roadkill application*. Total of 21 roadkills cases was detected and majorly happen on highway road compared to local road. This conclude that the application is beneficial to be used in Jeli area and could obtain a bigger datasets and gather roving records of road-kills and systematic monitoring of road-kills. It can be easily utilize by public citizen scientists, facilitated by tools like smartphones indeed deliver big data and take road-kill monitoring for monitoring and research purposes.

## 5.2 Recommendation

Several recommendations can be drawn from this study, which are:

- Data collection should continuously collect all-year-long or by monthly to increase the accuracy of hotspots area in estimating road-kill cases in Kelantan.
- Broader the study area to have the bigger view of extend of highway road-kill cases.
- Several researchers can work together at the same time but in different places needed are during the survey to make sure the undiscovered road-kill incidents could be minimalized.

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