

**A COMPUTER-BASED
APPLICATION ADVISORY SYSTEM FOR
BICYCLE SAFETY AT CAMPUS
TOWARDS SUSTAINABLE
TRANSPORTATION**

MOHAMAD WAFIY BIN ALDAM

**FACULTY OF ENGINEERING
UNIVERSITI MALAYSIA
SABAH 2022**



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APPLICATION ADVISORY SYSTEM FOR
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TRANSPORTATION**

MOHAMAD WAFIY BIN ALDAM

**THESIS SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENT FOR
THE DEGREE OF BACHELOR OF CIVIL
ENGINEERING**

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SABAH 2022**



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BORANG PENGESAHAN TESIS

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Mohamad Wafiy Bin Aldam

18 June 2022



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ABSTRACT

Bicycle safety is a concerning issue as it leads to accidents among cyclists who use bicycles as their mode of transportation, especially in campus areas. This research discusses the development of an advisory system for bicycle safety (AS-BS) to help cyclists gain information and make better decisions before and during cycling that will help avoid things that might cause an accident. Acquisition of knowledge from domain experts (engineers who worked in the area of road traffic safety or transportation engineering) and various sources such as books and journals are crucial for the advisory system knowledge database. The data from journals and other literature studies will be collected and then placed in the google form. The google form will then be send to domain experts to ask them to choose the best answer for each problem. After that, data gathered from domain experts will be analysed and reasoned. The relevant data was then retrieved and codified to create the knowledge base in the AS-BS. Then, the application of AS-BS is developed using the programming language Visual Basic in Microsoft Visual Studio 2019. AS-BS have been verified, validated, and evaluated at the final stage to ensure users' specifications, quality, and acceptance. The verification, validation, and evaluation were conducted using a questionnaire involving the researcher, expert evaluators, and end-users (students at UMS). Based on the result, the AS-BS passed its verification and validation. Also, the acceptance of the AS-BS by the end users is high, and it can provide an optimum strategy to advise cyclists about bicycle safety.



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ABSTRAK

APLIKASI SISTEM NASIHAT BERASASKAN KOMPUTER UNTUK KESELAMATAN BASIKAL KE ARAH PENGANGKUTAN YANG MAMPAN

Keselamatan basikal adalah isu yang membimbangkan kerana ia membawa kepada kemalangan dalam kalangan penunggang basikal yang menggunakan basikal sebagai pengangkutan mereka, terutamanya di kawasan kampus. Penyelidikan ini membincangkan pembangunan sistem nasihat untuk keselamatan basikal (AS-BS) untuk membantu penunggang basikal mendapatkan maklumat dan membuat keputusan yang lebih baik sebelum dan semasa berbasikal yang akan membantu mengelakkan perkara yang mungkin menyebabkan kemalangan. Pemerolehan pengetahuan daripada pakar domain (jurutera yang bekerja dalam bidang keselamatan lalu lintas jalan raya atau kejuruteraan pengangkutan) dan pelbagai sumber seperti buku dan jurnal adalah penting untuk pangkalan data pengetahuan sistem nasihat. Data dari jurnal dan kajian literatur lain akan dikumpul dan kemudian diletakkan di dalam google form. Borang google kemudiannya akan diedarkan kepada pakar domain untuk meminta mereka memilih jawapan yang terbaik untuk setiap permasalahan. Selepas itu, data yang dikumpul daripada pakar domain akan dianalisis dan dihuraikan. Data yang berkaitan kemudiannya diambil dan dikodkan untuk mencipta pangkalan pengetahuan dalam AS-BS. Kemudian, aplikasi AS-BS dibangunkan menggunakan bahasa pengaturcaraan Visual Basic dalam Microsoft Visual Studio 2019. AS-BS telah disemak, disahkan dan dinilai pada peringkat akhir untuk memastikan spesifikasi, kualiti dan penerimaan pengguna. Penyemakan, pengesahan dan penilaian dijalankan menggunakan kaedah soal selidik yang melibatkan penyelidik, penilai pakar dan pengguna akhir (pelajar di UMS). Berdasarkan keputusan itu, AS-BS telah lulus pada peringkat pengesahan dan pengesahannya. Selain itu, penerimaan AS-BS oleh pengguna akhir adalah tinggi, dan ia boleh menyediakan strategi optimum untuk menasihati penunggang basikal tentang keselamatan basikal.



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LIST OF ABBREVIATION

UMS	Universiti Malaysia Sabah
AS-BS	Advisory System for Bicycle Safety



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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Each year, over 85 million adults and children ride bicycles. When children and young people travel freely, the bicycle is their dominant mode of transport (World Health Organization, 2020). Every morning, an estimated half million individuals in the United States ride to work (Brown et al., 2021). Unfortunately, injuries do occur. About 500,000 cyclists of all ages incur a bicycle accident that needs hospitalisation. Around 750 bicycles were killed each year in traffic collisions (Gkekas et al., 2020). Perhaps unsurprisingly, more than half of cyclists who ride in or near traffic express a sense of insecurity. In a country where traffic is expanding and highways are getting more crowded, authorities or engineers must assure the safety of all roadway users to the best of their abilities.

To educate the public about bicycle safety, authorities or transportation engineers should adapt to the modern method of delivering information. In this modern age of technology, individuals prefer to gain information via e-resources rather than through conventional sources. The rise of smartphones, laptops, and desktop computers has made application use easier. Individuals may readily get specific information when they want it.



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Cycling is a low-cost, low-pollution mode of transportation for communities, and it is widely recognized as a clean, sustainable solution to 21st-century issues such as pollution and traffic congestion. In Malaysia, the transportation industry consumes roughly 35% of total energy and emits over 50 million metric tonnes (Mt) of Carbon dioxide per year, second only to electrical power production. The great bulk of transportation emissions, 85.2 percent, originate from road travel. While biking cannot solve all transportation problems, it does have the potential to ease some of them. Cycling has been found to have a major impact on carbon dioxide emissions reduction and urban safety (Kelarestaghi et al., 2019).

Cycling is a crucial component of sustainable transportation in developing nations since it benefits users' mobility and accessibility while also benefiting the environment due to its zero-emission status (Shaheen et al., 2011). Bicycles have been proved to improve mobility, accessibility, and the environment in large cities and suburbs as a form of Non-Motorised Transport (NMT) (Pucher & Dijkstra, 2000; Shaheen et al., 2011). The purpose of this project is to develop a computer-based advisory system for enhancing safety among cyclist and to encourage people to ride bicycles instead of motorised vehicles. When more people use bicycle, the number of motorised vehicles will be reduced. Thus, low pollution gases are emitted. So, sustainable transportation can be achieved.

Cycling provides a plethora of health and environmental advantages. Nonetheless, 41 000 cyclists die each year in road traffic accidents globally. Many people leave their houses as they would on normal days — for school, work, or socialising – never to return. Millions more individuals are injured in cycling-related road traffic collisions, with some being permanently injured. These tragedies result in significant pain and sadness for families and loved ones, as well as economic difficulties. (World Health Organization, 2020)



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However, with the increased emphasis on sustainable mobility – the endeavour to move more travel away from motorised transport and toward public transportation, walking, and cycling – the safety of cyclists becomes an increasingly crucial component of road safety measures. As with other road traffic incidents, cyclist collisions are foreseeable and avoidable and should not be considered as inevitable. (World Health Organization, 2020)

Cycling has greatly increased in recent years as a healthful, cost-effective, and environmentally friendly mode of transportation. Numerous transportation officials seek to make cycling a way of life to further the car-lite objective and enhance a city's or nation's overall liability. However, one of the most significant impediments to cycling's rise is safety concerns since cyclists are more vulnerable than automobile passengers. To achieve the long-term goal of lowering congestion and pollution via increased bike usage, public fear of being in an accident must be addressed (Kaplan et al., 2015).

Three main priorities exist for enhancing bicycle safety on campus, which are minimize cyclist injuries, increase bicycle use, and reduce air pollution by lowering the use of motorised cars. Then, introducing bicycle safety measures may dramatically minimize cyclist injuries. This is accomplished by determining the source of the problem and communicating the knowledge to end users so they can avoid it. Additionally, this method may encourage individuals to ride bicycles by instilling trust in them that cycling is a safe mode of transportation. Following that, if more people ride bicycles, the number of motorised cars will decrease. As a result, pollutants will be decreased.

Bicycle accidents may be caused by a variety of circumstances, including failure to wear a helmet, poor maintenance of the bicycle, and self-neglect while riding. Cyclists are highly susceptible since they move at lower speeds than motorised vehicles and might be harder to spot, and they are also less protected in the case of an accident than drivers of motorised vehicles. Cyclists are often on the road mixing directly with other vehicles moving at a faster rate than they are. Thus, it will cause raising in the risk of getting involved in an accident with a vehicle of more bulk than themselves.



Therefore, this study will focus on developing a computer-based application advisory system for bicycle safety on campus in order to promote sustainable transportation. The purpose of this project is to determine ways of reducing fatal injuries during bicycle accidents by developing an advisory system that provides end users with wide information about the importance of safety issues during cycling. Also, the development of advisory system is to make users more aware about the factors that lead to bicycle accidents. As a result, knowledge base programming approaches will be used in this advisory system in order to give an effective and systematic approach to cyclists who use bicycles as their primary mode of transportation around campus areas.

This research addressed various gaps, including a lack of understanding regarding bicycle safety among the campus community (students and staffs), the absence of a campus-specific cycling advisory system, and a rising incidence of bicycle accidents on campus. This advisory system is crucial not just for avoiding an accident among cyclists, but also for assisting engineers in making decisions on how to address corresponding traffic or transportation problems. Additionally, it is beneficial for young engineers with limited industrial experience to broaden their expertise, especially for transport engineers. Transport experts are also given the opportunity to contribute their expertise through this advisory system in order to improve the end user's comprehension.

1.2 Problem Statement

Bicycle safety is a major concern because it affects how people see bicycles as a mode of transport. If their safety is in doubt, they will go for other forms of transport such as automobiles and motorcycles. Thus, developing an effective advisory system is crucial for mitigating and resolving this problem. To successfully determine an appropriate solution, problem statements must be recognized. In this research, there are three problem statements are identified and are further discussed in the following subsections.



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Firstly, increasing number of accidents among cyclists. Police have recorded 137 accident cases involving cyclists nationwide between January and October, based on Bukit Aman Traffic Investigation and Enforcement Department whereby, 56 were fatal accidents, 18 suffered serious injuries while 63 were minor injuries. Last year, police recorded 201 cycling-related accident cases, with 107 deaths, 35 serious injuries and 59 minor injuries (Bernama, 2020). Cycling on the road has become a new trend among Malaysians of lately. However, an increasing number of people on the road will cause an increase in the number of collisions.

Secondly, there were no interactive media that have been developed for delivering information related to bicycle safety specifically at campus area. Interactive media such as advisory system is crucial because it can deliver information effectively compared to traditional method. Thus, in this research the researcher will create an advisory system for delivering information, particularly about bicycle safety. Also, the researcher could utilise technological advancements by developing an advisory system.

Lastly, no dedicated bicycle safety advisory system that developed specifically for use in campus area. All of the systems explored by previous researchers are complex; hence, an advisory system will be created that is simpler but yet contains important information about bicycle safety and is suited for cyclists on campus areas. Additionally, past research on the advisory system concentrated on topics other than transportation, most notably bicycle safety. As a result, the advisory system that will be built in this project will be primarily focused on bicycle safety.



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1.3 Definition

The title for this project is a development of advisory system for bicycle safety at campus towards sustainable transportation. The definition of terms in title are shown in table below.

Table 1.1: Definition of Terms in Title of Project

NO.	Title	Definitions	Source
1.	A computer based	A computer-based is a structured systems that rely on computer hardware and software technology to collect, process, store and distribute didactical resources	(Mandic et al., 2012)
2.	Application	Application is a computer software package that performs a specific task for a user or in certain situations for another application.	(Ahookhosh et al., 2021)
3.	Advisory System	<ul style="list-style-type: none">• Advisory systems provide advice rather than presenting a solution to the decision maker.• Provide advice and help to solve problem that are normally solved by expert	(Bourne et al., 2017)
4.	Bicycle safety	A decision-making tool for policymakers and practitioners, this information resource discusses the extent of cycling fatalities and injuries, the primary risk factors, and successful solutions. The statement emphasizes the significance of a complete, holistic strategy that includes legislation, enforcement, and behavioral measures for cyclists; developing design; and incorporating bicycle safety into overall road safety and transportation initiatives. Additionally, it emphasizes the advantages of cycling, which should be encouraged as a viable mode of transportation given its potential to enhance	(Terzano, 2013)



	health and protect the environment.	
5. Sustainable transportation	Sustainable transport is described as the capacity of people and things to move freely without harming natural constitutional or ecological values, such as affordability for socially disadvantaged groups and the financial viability of transportation networks over the long term. This often entails efficient transportation at a fair cost with an acceptable degree of safety, without creating emissions or waste products greater than the environment's capacity to absorb them.	(Martins et al., 2019)

1.4 Objectives of The Study

The main goal of this research is to develop a computer-based application advisory system for bicycle safety, which will be used specifically on the campus area. In order to achieve this goal, the following objectives must be accomplished:

1. To analyse the related information regarding the bicycle safety and causes of accidents among bicycle users through literature review and interview with transportation expert.
2. To develop an interactive computer-based application advisory system for bicycle users' information.
3. To evaluate, verify and validate the computer-based application advisory system for bicycle safety at campus area by reflecting the acceptance of the end-user.



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1.5 Significance of Study

This study is crucial because it has the potential to encourage campus community (students and staffs) to use bicycles as their primary mode of transportation when traveling around the campus area. By establishing this advisory system, researcher helps in increasing trust of most people that bicycles are one of the safest modes of transportation and they also will help to preserve the environment since they do not emit polluting gases such as carbon monoxide while riding. This will assist in the fulfilment of the trip and the use of environmentally friendly modes of transportation. It is possible to communicate information to individuals in an engaging manner via the use of an advisory system.

1.6 Scope of Study

The survey in this research is done among students and faculty members around the campus area. The scope of this research is limited to the topic of bicycle safety among those who circulate around campus. The information gathered was delivered through the advisory system and examined by transportation professionals with extensive experience. The suggestions derived from this research are the most suitable ones possible after taking into consideration a variety of elements and information obtained from different reading sources and expert interviews. It is anticipated that the findings of this research will help to prevent bicycle-related incidents by providing cyclists with knowledge on how to ride their bicycles in the safest possible manner. Additionally, the system will prescribe safety precautions to be done before, during, and after riding activities.



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