USING AN INSTRUMENTED BICYCLE TO HELP UNDERSTAND CYCLISTS' PERCEPTION OF RISK

H. ETEMAD, S.B. COSTELLO and D.J. WILSON

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

Introduction

The absence of bicycle facilities along roads forces cyclists to travel in the roadway, often leading to a higher cyclist crash risk. In addition, bicycles have a much lower level of protection and stability by comparison with motorized vehicles and therefore cyclists are exposed to a higher level of risk on the road. Decision making (such as modal choice and route choice) and behaviour of road users in different situations are influenced by perceptions of risk.

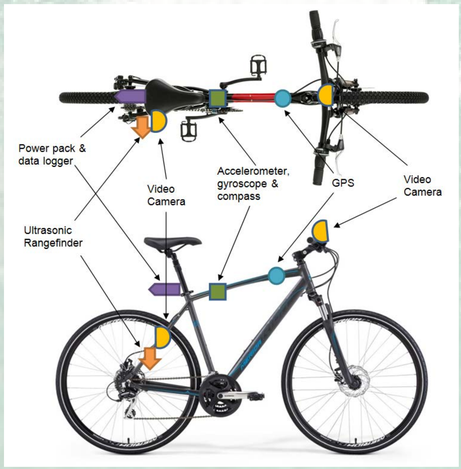
This research forms part of a doctoral research project undertaken at the University of Auckland which will attempt to understand cyclists' perceptions of risk in relation to cycle safety, through a combination of interviews with cyclists about the perceived risk to their safety on selected routes and the use of an instrumented bicycle on the same routes. The intention is to be able to estimate perceived risk of a route based on objective measures of the surrounding infrastructure and traffic.

Methodology

The following sections describe the chosen "standard" bicycle to be used in the study, as well as the instrumentation attached to the bicycle, the purpose of said instrumentation, the data logger and power source adopted.

An Avanti Giro F1 hybrid bicycle has been chosen for this study. This is a general-purpose bicycle that is able to tolerate a wide range of riding conditions. It is a comfortable and easy to handle bicycle that make it popular with beginner cyclists, casual riders, commuters, and children. A comparable "standard" bicycle has also been chosen in similar studies overseas.

The location of the instrumentation on the bicycle is detailed in the schematic in Figure below:



Instruments:

- Camera
- GPS
- Ultrasonic Range Finder
- Accelerometer/gyroscope & compass
- Data Logger
- Power Source
- Screen
- Keyboard

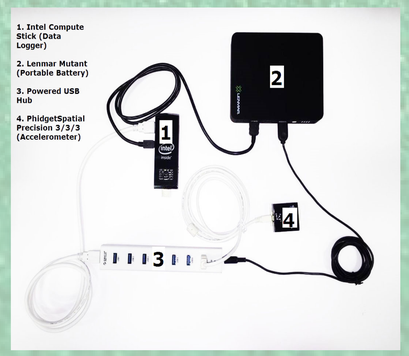
- A Phidget GPS is used to continuously record location, as well as providing timestamps and speed of the instrumented bicycle.

- A PhidgetSpatial Precision 3/3/3 (High Resolution) provides a 3-axis compass, a 3-axis gyroscope, and a 3-axis accelerometer all in one convenient package.

- An ultrasonic distance measuring sensor is used to examine the proximity (passing distance) between motorized vehicles and cyclists when the motorized vehicles are overtaking the cyclist. The chosen device, a Maxbotix HRUSB-MaxSonar-EZ0 has a wide and sensitive beam pattern and is installed facing overtaking vehicles.

A small size single board computer, the Intel Compute Stick is used in this study as a data logger to store the data from the variety of the sensors including the GPS, ultrasonic rangefinder , accelerometer.

All sensors are connected to data logger through powered USB hub. A portable power pack is used as battery sources for all of the electronic sensors.



- The bicycle has two compact video cameras. One of the video cameras is installed on the handlebar of the instrumented bicycle facing the direction of travel to record video information on conflicts. A second video camera is rear facing, directed towards the traffic to record passing vehicles.

Future Research

The ongoing doctoral research programme will attempt to understand cyclists' perceptions of risk in relation to cycle safety, through a combination of interviews with cyclists about the perceived risk to their safety on selected routes and the use of the instrumented bicycle on the same routes. Participants will be asked to assign a perceived level of risk to sections of a range of cyclist commuting routes. Volunteers will be required to participate in this "Rate my Route" part of the research.

The intention is to be able to estimate perceived risk of a route based on objective measures of the surrounding infrastructure and traffic. The long-term goal is to develop a cycle risk safety index (CRSI) which will provide a relative indicator for cyclist safety, thereby helping to inform cyclists of safer route choices.

Conclusion

The built environment for cyclists affects their safety. For example, the absence of bicycle infrastructure and provisions along roads forces cyclists to travel in the roadway - often leading to a higher cyclist crash risk. In addition, bicycles have a much lower level of protection and stability by comparison with motorised vehicles and, therefore, cyclists are exposed to a higher level of risk on the road. Decision making (such as modal choice and route choice) and behaviour of road users in different situations are influenced by perceptions of risk.

Previous research has demonstrated the value of naturalistic cycling data in understanding the behaviour of drivers in relation to cyclists for a number of scenarios. This research also intends to adopt a naturalistic cycling methodology and, to that end, an instrumented bicycle has been developed which will collect information on the location, direction of travel, gradient, acceleration in 3 axes, proximity to traffic, as well as video footage. Coupled with information of the surrounding transport infrastructure provision it is hoped to increase our understanding of cyclists' perception of risk.

Acknowledgements

I would like to thank Dr. Seosamh Costello, Dr. Douglas Wilson and Sujith padiyara for their greatly appreciated advice and assistance with this project.