



# Vehicle Blind Spot Assist # 2011317

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## Motivation

- Accidents during lane changes are common due to drivers not checking their blind spots
- Companies such as BMW, Volvo, Ford etc have implemented blind spot assist devices on their models, however, universal devices are not widely available
- Accident rates are decreasing as safety technology becomes more of a concern, but there's room for improvement

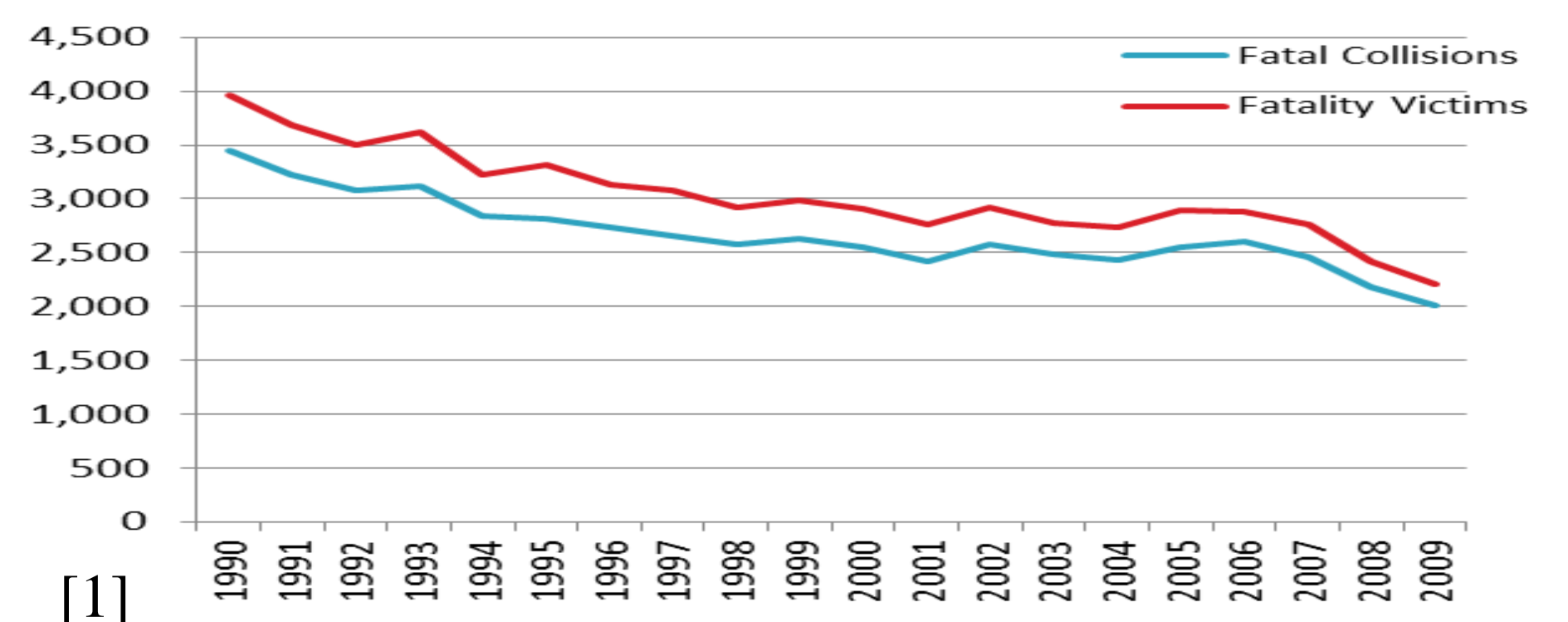
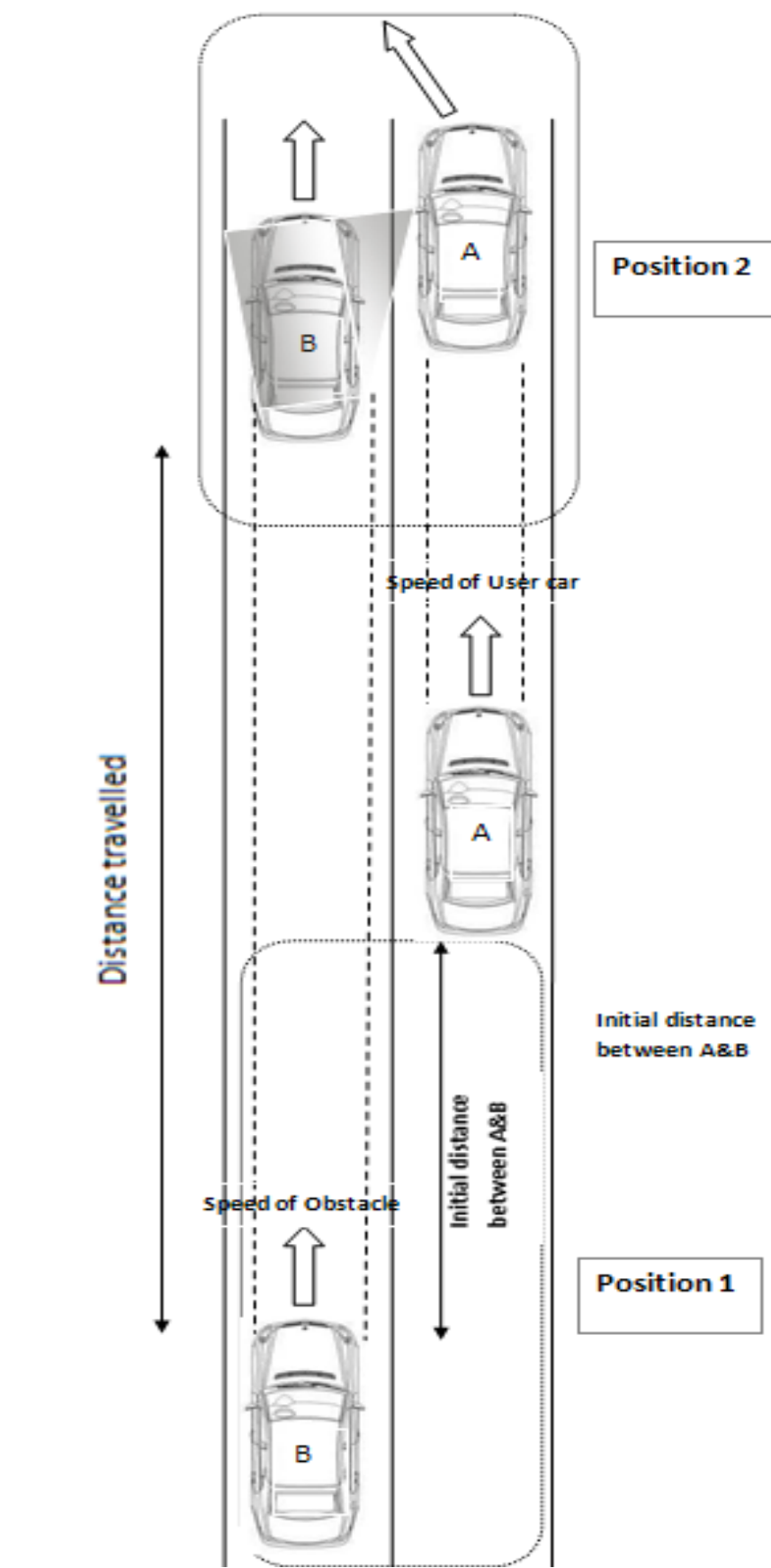


Figure 5: Fatal Collisions and Fatality Victims (1990-2009)

## Project Goal

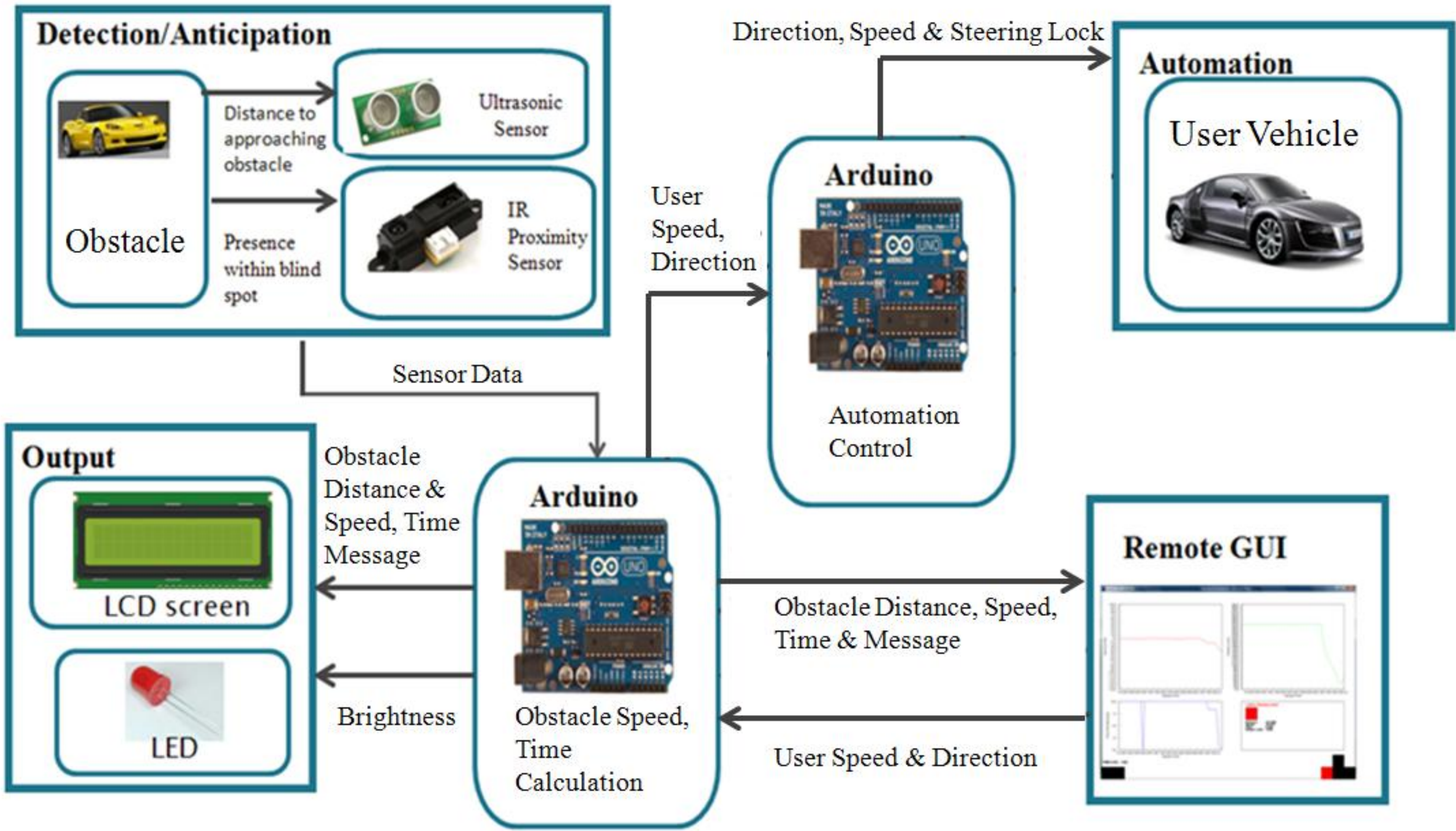
- Assist in accident prevention through a device that will help users identify and anticipate obstacles in their vehicle's blind spot
- Provide an additional level of accident prevention through the implementation of an automated steering lock feature based on relative danger levels

## Proposed Concept



- Obtain distance between user car, and obstacle car
- Calculate the relative speed between the two vehicles
- Calculate how long the obstacle will take to go from position 1 to position 2 (time remaining)
- Provide lane change advice to the user based on the time remaining value
- Lock the user vehicle's steering if the time is too low to prevent dangerous lane changes

## System Level Overview



## Module Level Tests

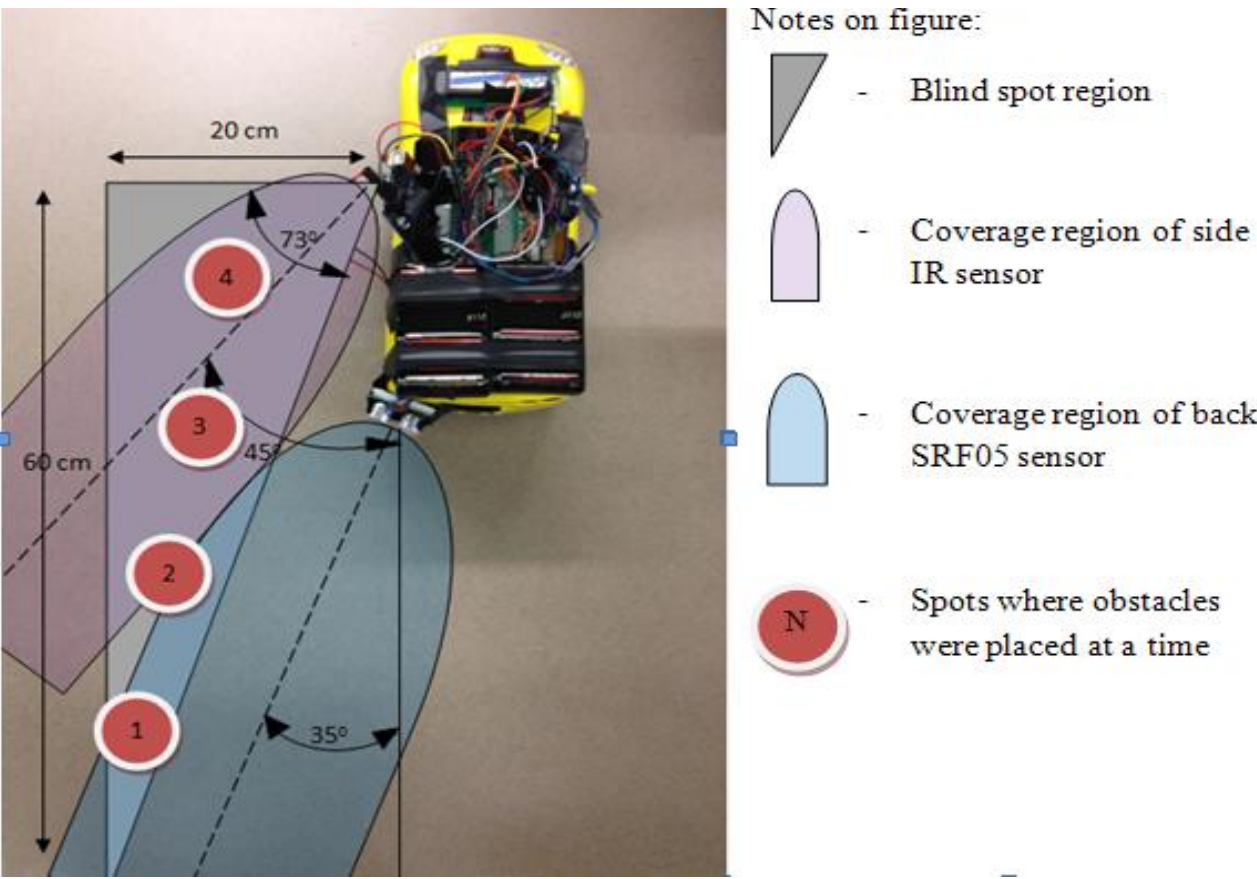
### Speed Tests

Test	User Vehicle PWM %	Measured Relative speed, [cm/s]	Calculated Relative Speeds, [cm/s]	Error %	Plot of Calculated Relative Speeds
1	41%	75.78	72.00	5.20	
2	51%	24.14	23.00	4.90	
3	61%	-0.60	-0.6	0.00	

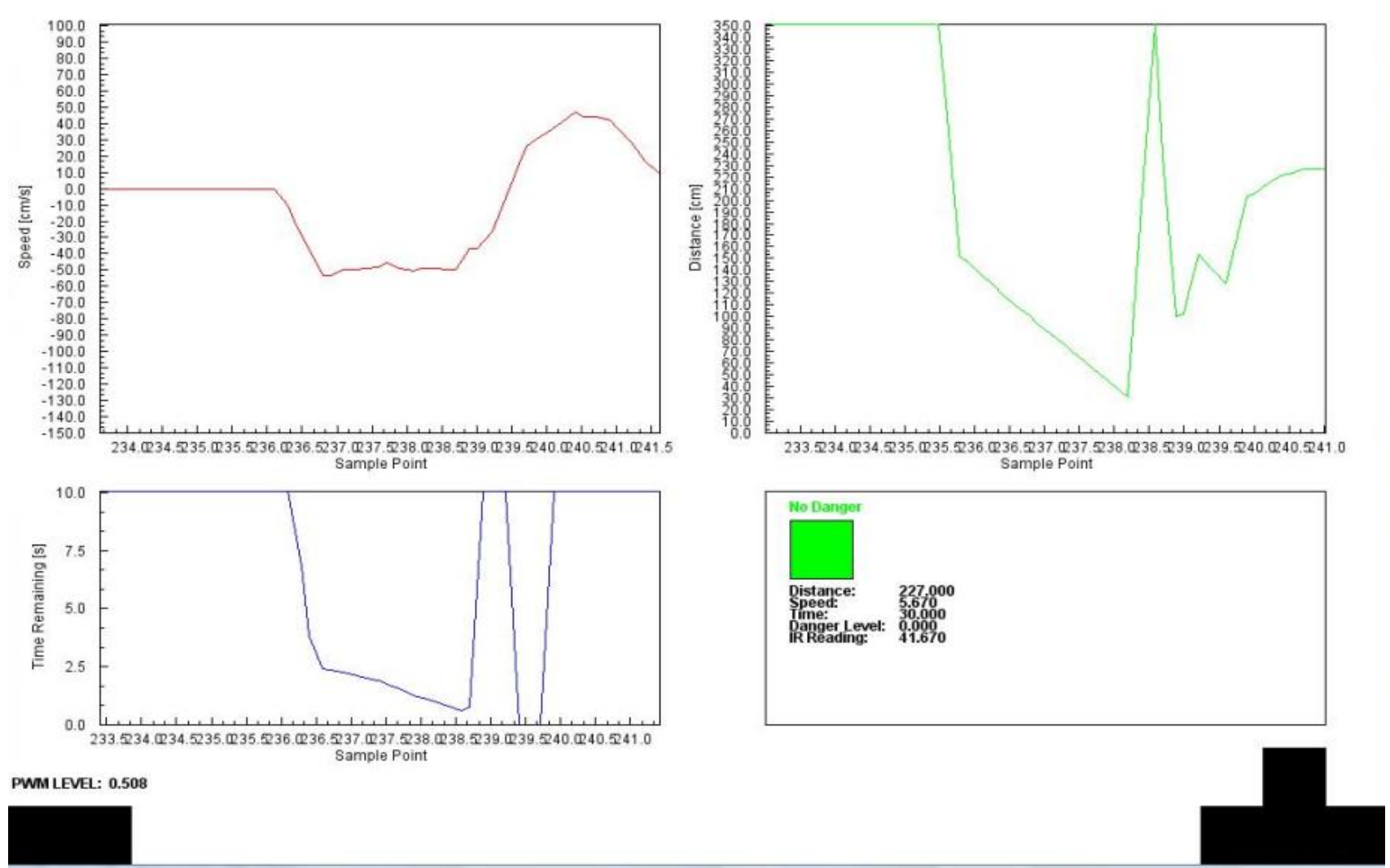
### Distance Tests

Ultrasonic			Infrared		
Actual distance (cm)	Test Result (cm)	Error, %	Actual Distance (cm)	Test Result	Error, %
5	5	0.00	7.00	7.20	2.70
1	101	1.00	12.00	12.08	0.60
2	201	0.50	20.00	20.26	1.30
3	300	0.00			

### Blind Spot Coverage Test

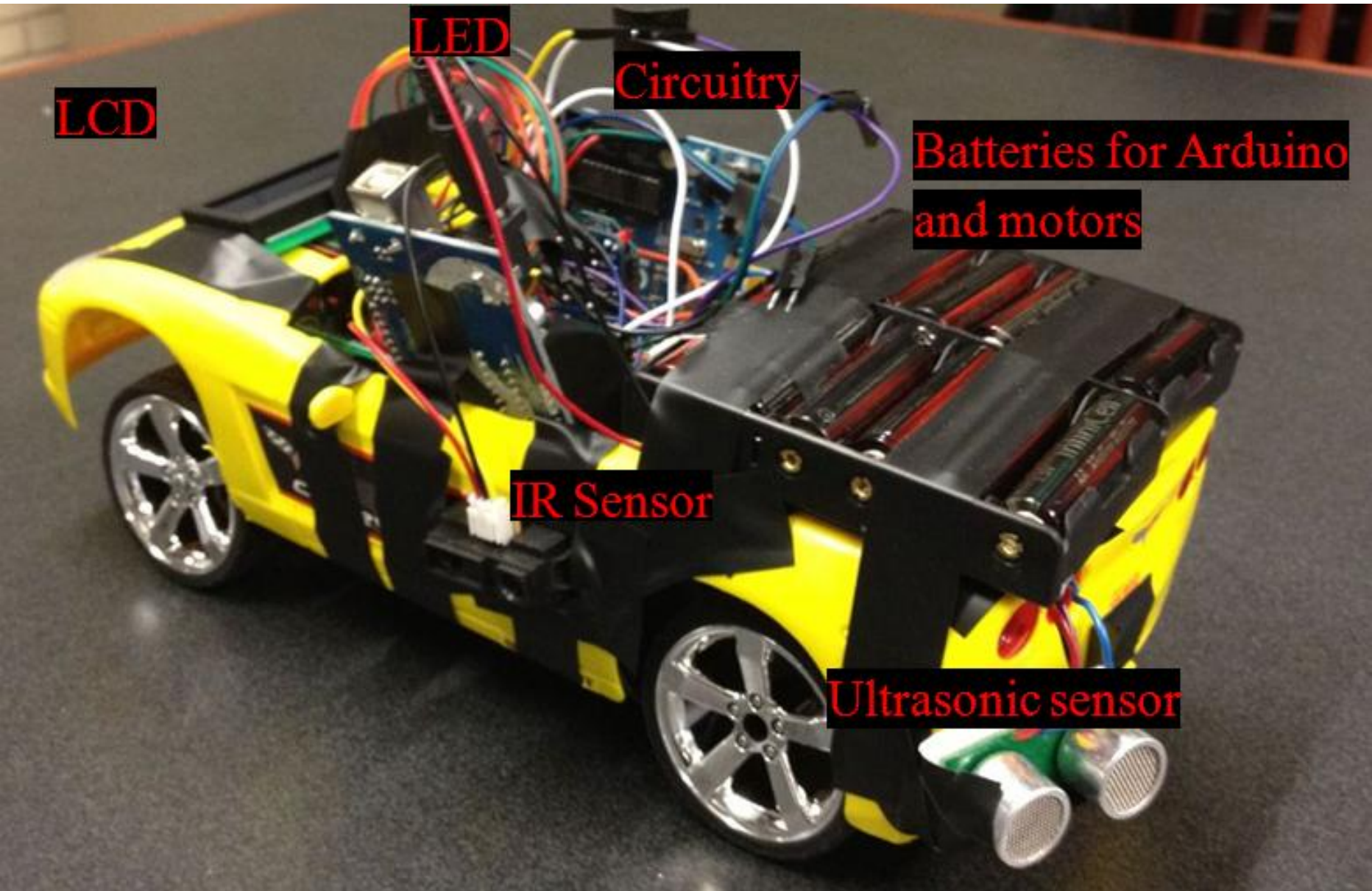


## System Level Test

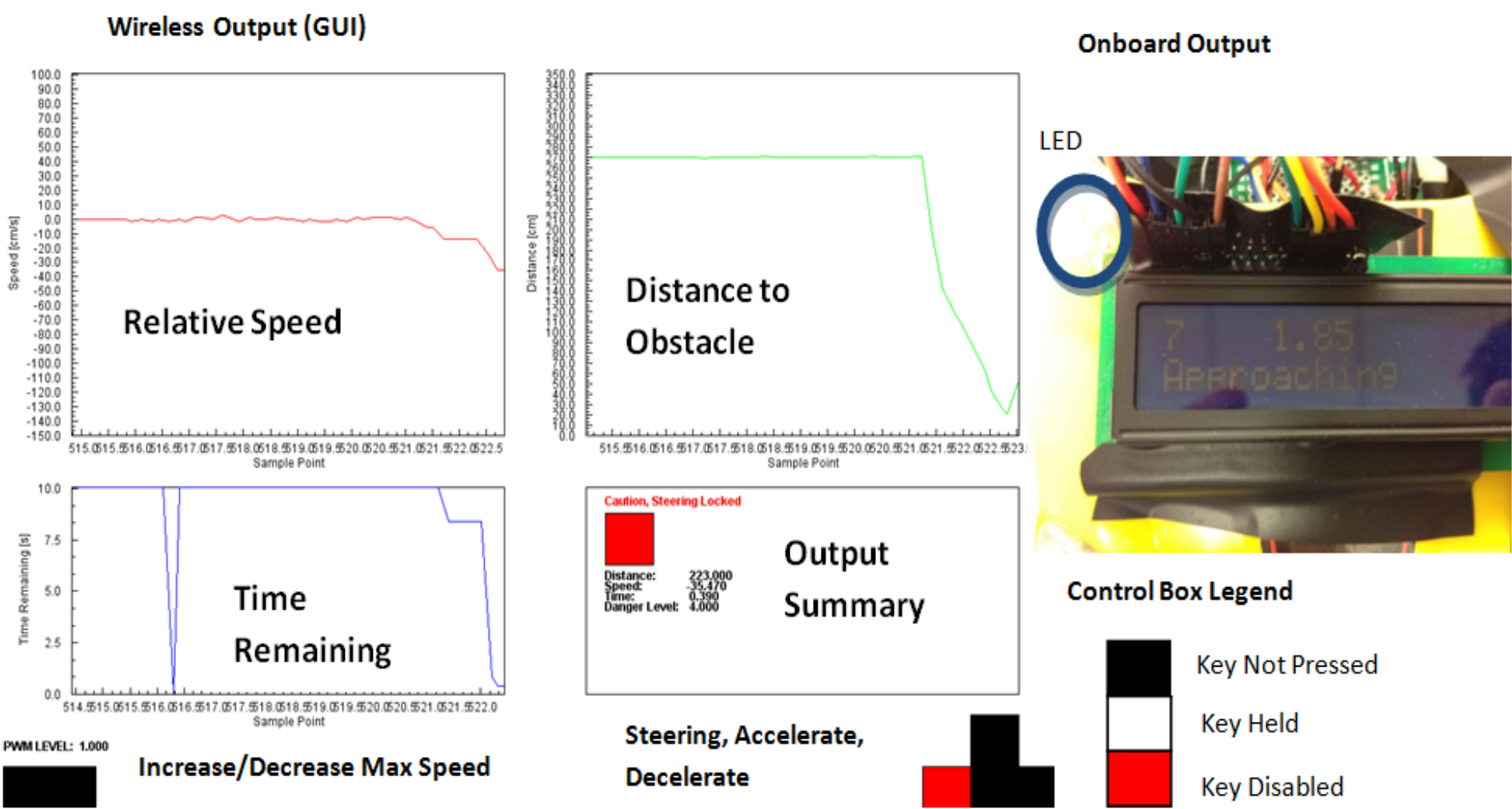


System Level Test	
Objective:	Device should accurately determine danger levels, and lock the steering accordingly
Test Setup	<ul style="list-style-type: none"><li>- Obstacle car and user car run with different known speeds</li><li>- Relative speed, distance and remaining time plots are observed</li><li>- For cases where time remaining was below the threshold, or an obstacle was already present in the blind spot, successful steering lock was observed</li></ul>
Feedback & Observations	<ul style="list-style-type: none"><li>- Distance, Speed and time are calculated accurately; user is unable to collide into obstacle as the steering is locked when time remaining falls below the specified threshold</li></ul>

## Physical Design



## Output Design



## Danger Levels and Output Table

Situation	Time Left [s]	Range r	LCD Screen Output	LED Output
No Danger	$t > 15$	0	Distance to obstacle, "No Danger"	Off
Obstacle Approaching	$11 < t < 15$	1	Distance to obstacle, relative speed, "Obstacle Approaching"	Brightness from 0% to 78%, depending on increasing distance
Obstacle Approaching	$6 < t < 11$	2		
Obstacle Approaching	$3 < t < 6$	3		
Obstacle Very Near	$t < 3$	4	Distance to obstacle, relative speed, "Caution"	Fully On
Obstacle at Blind Spot	$t \leq 0$	5	"Danger, Check Blind Spot"	Fully On + Steering Lock

## Conclusions and Future Work

- The prototype meets the initial objectives within a scaled down environment
- Improvements can be made to:
  - Noise filtering algorithms
  - Response time of the device
  - Sensor placement
- With advanced sensors and algorithm optimizations the detection/anticipation component of the device can be implemented on real vehicles

## Acknowledgements

Micah Stickel, Ross Gillett, Khoman Phang, Lawrence Chan, Mike Mehramiz

## References

[1] Transport Canada, "Canadian Motor Vehicle Traffic Collision Statistics: 2009", Internet: <http://www.tc.gc.ca/eng/roadsafety/resources-researchstats-menu-847.htm>, Jun. 01, 2011 [Sep.11, 2011].