Third Eye: Blind Spot Detection System for Cyclists

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Objective

To design a robust, low-cost, and user-friendly traffic detection and collision avoidance system for cyclists.

Background

A major concern for commuting cyclists is that their safety depends on the actions of other road users.

- Around 7,500 cyclists are injured every year in Canada.
- 92% of all bicycle-related fatalities involve motor vehicles and 94% of those fatalities were due to driver inattention.

Third Eye works to lower these statistics by allowing cyclists to be aware of potential dangers.

Third Eye provides automated alerts and lowers the headphone volume in cases of dense traffic.

Sensor Beam Characteristics

The detection pattern is shown for dowels of various diameters placed in front of the sensor. The scale is 1 inch per square.

A: 0.25 inch dowel
B: 1 inch dowel
C: 3.5 inch dowel
D: 11 inch dowel

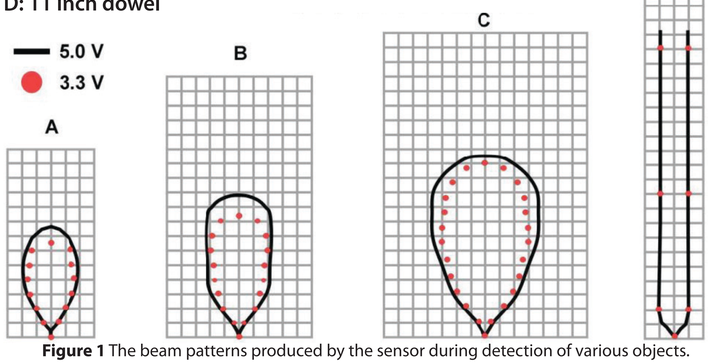

Figure 1 The beam patterns produced by the sensor during detection of various objects.

Results & Prototype

The system is able to detect large objects from 3 meters away and determine whether an object is moving towards or away from the cyclist. The prototype system uses a Blend Micro microcontroller paired with a MaxBotix MB1000 ultrasonic sensor.

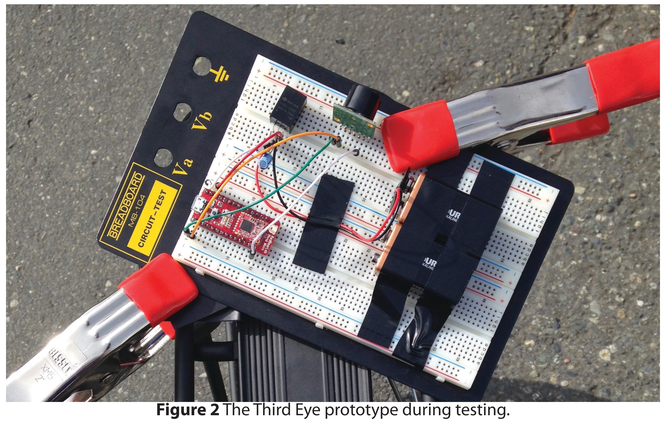

Figure 2 The Third Eye prototype during testing.

Operating Concept

Custom software processes the data from the sensor by averaging and smoothing the data.

A linear trend is fit to several data points, and the trend's slope is used to find the closing speed of the object.

The microcontroller uses the closing speed and distance to determine if the object is a danger to the cyclist.

An alert is sent to the companion app on the iPhone, and the iPhone either plays an alert or lowers the headphone volume to warn the cyclist.

Figure 3 A situation where Third Eye would be useful.

Alert Conditions

Condition	Distance (metres)	Speed Difference (km/h)	Time until Collision (s)	Alert Class
Moving towards and close	3	10.8	1	Alert 1
Moving towards and close	3	5.4	2	Alert 2
Moving towards and close	3	3.6	3	Alert 3
Moving towards and close	2	7.2	1	Alert 1
Moving towards and close	2	3.6	2	Alert 2
Moving towards and close	2	2.4	3	Alert 3
Moving towards and close	1	3.6	1	Alert 1
Moving towards and close	1	1.8	2	Alert 2
Moving towards and close	1	1.2	3	Alert 3
Not moving and close	2.5	N/A	N/A	Alert 4
Moving away and close	N/A	N/A	N/A	Alert 5

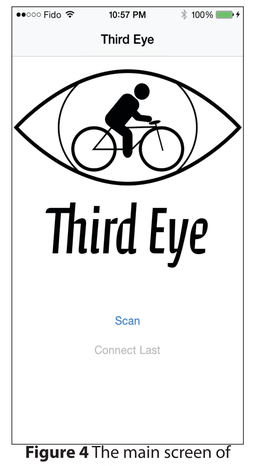

Figure 4 The main screen of the iPhone app

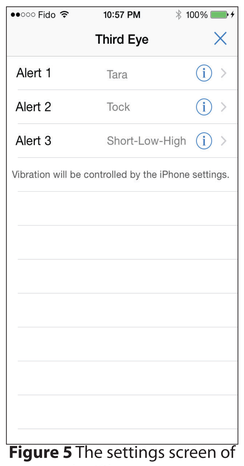

Figure 5 The settings screen of the iPhone app

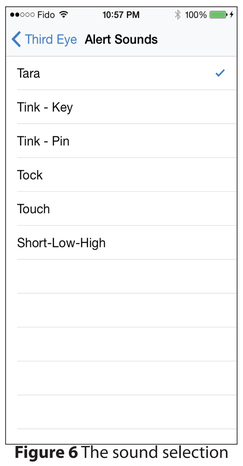

Figure 6 The sound selection screen of the iPhone app