Safe and Aware on the Bike
An advisory system for elderly cyclists for improving safety and comfort

Ageing and Safe Mobility conference - BASSt, Germany - November 27-28 2014

Maurice Kwakkernaat, Stefanie de Hair, et al. (TNO)
presented by Lex van Rooij (TNO)
Background

Netherlands

- Bike paths → increasingly more crowded due to 7% increase in use
- Electric bicycles → more often and 2x longer on the bicycle
- Risk of crashes/falls → potentially increased risk of injury
- How to make cycling safer and more comfortable?
  - 2013 project resulted in specification of advisory system!
Bicycle use has increased with 7% in last decade

Electrically assisted bicycles (E-bikes) constitute 12% of all bicycles

Average distance on E-bikes: 6.3 km per day
2x more than on regular bicycles
Background

FIETS ADVIES SYSTEEM
Goals

- Reduction of single-sided bicycle accidents
- Accelerated time-to-market of concept and technology

<table>
<thead>
<tr>
<th>Year</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Problem definition</td>
</tr>
<tr>
<td>2014</td>
<td>Technology development &amp; business plan</td>
</tr>
<tr>
<td>2015</td>
<td>Testing with elderly &amp; dissemination</td>
</tr>
</tbody>
</table>

>60yo single-sided bicycle accident causes (GIDAS)

- Weekday: 17
- Weekend: 16
- Roof: 15
- Snow: 13
- Road: 12
- Hilly: 12
- Right: 8
- Left: 6
- Alkmaar: 5
- Alkmaar: 5
- Hoogeveen: 5
- Veenendaal: 2
- Deventer: 2
- Helling: 2
- Other: 2
2014 Objectives

- Advisory system → Proof-of-concept

- Proof-of-concept is basis for testing and evaluation in 2015
- Problem definition phase in 2013 resulted in:
  - Rearview assistant
  - Obstacle detection
  - Route advisory system
Rearview assistant

Objective:
- Detection of rear-end traffic
  - Vehicles, cyclists, pedestrians
  - Inform and warn bicyclist

Feasibility testing
Using:
- TNO car-lab & TNO bicycle-lab
- Automotive Camera (Mobileye 560)
  - Object detection
- Data processing
- Tablet PC & Mobileye display (HMI)
Rearview assistant
Feasibility testing
Data verwerking

› Waarnemen
  › Mobileye camera genereert object data
› Data verwerken
  › Embedded pc met iVSP software
    › iVSP: intelligent Vehicle Safety Platform (TNO)
  › Filtering, risicoschatting, waarschuwing
  › Input voor HMI
› Informatie en waarschuwing naar gebruiker
  › Draadloos naar tablet
Eerste testen achteruitkijkassistent
Obstacle detection

Objective:
- Detection of obstacles ahead of bicycle
  - Predominantly static objects
- Inform and warn bicyclist

Feasibility testing
Using:
- TNO bicycle-lab
- 24 GHz automotive radar
- Data logging
- Offline data processing
Obstacle detection
Feasibility testing
The intelligent bicycle

- Haptics in handlebar grips (2)
- Haptics in saddle (2 x 3)
- Tablet for HMI
- Radar
- Mobileye
- Pedalling support on/off
Kern innovaties

› Toepassing radar en camera technologie
› Sensor informatie verwerking
› Modellen en applicatie logica
› Haptische feedback en HMI
› Systeemintegratie
HMI with haptic feedback

➤ Warning through haptic feedback
  ➤ Direct feedback with low cognitive load
➤ Haptic feedback on the bicycle
  ➤ Vibrating handlebar grips
  ➤ Vibrating saddle
➤ Pedalling support on/off
HMI via tablet (or smartphone)
Software

› Risico inschatting
› Genereren van waarschuwing
› Interface naar
  › Sensoren
  › Actuatoren
  › HMI
Design and integration
De intelligente fiets
The intelligent bicycle
Next steps (1/2)

- From automotive sensors to ultra low-cost
- System requirements
- Packaging
- Mini-radar, small camera
- System integration and optimisation

- Bicycle to infrastructure communication
Next steps (2/2)

- Verification and user testing with intelligent bicycle
- Optimisation of HMI and integration with route advisory system
- Partners for further development and market deployment
Contact

- TNO
- Maurice Kwakkernaat
- E: maurice.kwakkernaat@tno.nl
- T: 0888662442
- W: www.tno.nl
Transform any bike into a smart bike with Helios Bars.

**Powerful Headlight**
Powerful CREE LEDs provide you with a wide spread of illumination comparable to a car headlight. Our rechargeable batteries last 9 hours on the brightest setting.

**Bluetooth® Smart**
Connect Helios Bars to your smartphone via Bluetooth® Smart and unlock a variety of smart features including ambient lighting, turn-by-turn navigation, and more.

**GPS Tracker**
Track your bike (via SMS) from anywhere in the world. Receive the coordinates of your bike and a Google Maps link to its location within 30 seconds of tracking.

**Rear LEDs**
Rear facing LEDs function like turn signals on a car. Press the blinder button on either side of the stem in order to indicate to other vehicles that you're turning.