

INSTRUMENTED BICYCLE

IFX-AURIX@PoliTo-University

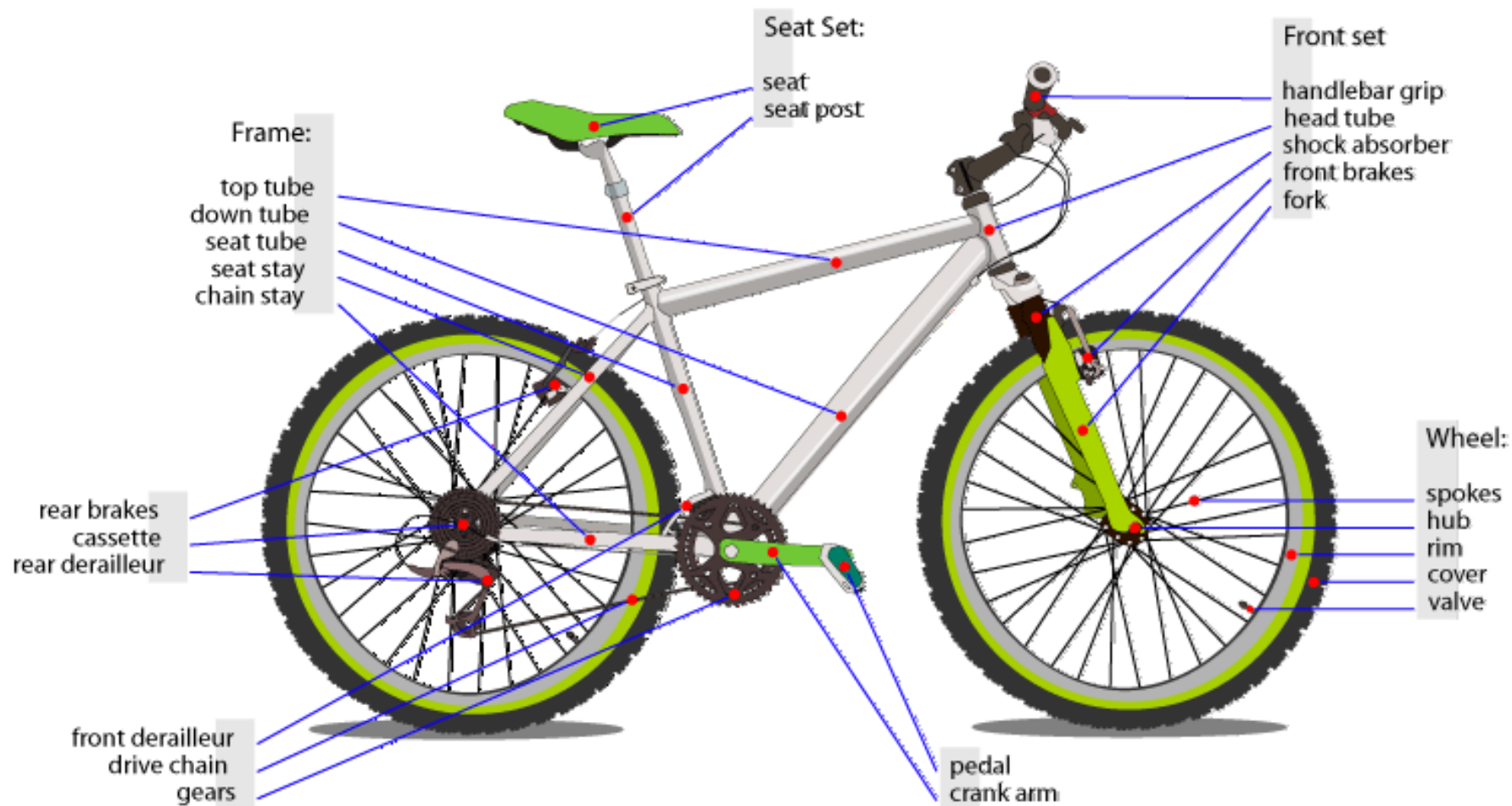


**POLITECNICO
DI TORINO**

Goal of the project

- › To setup the prototype of an electronic-assisted bicycle able to
 - Sense the environment
 - Sense the bicycle position
 - Warn the cyclist, pedestrian and car drivers
 - To prevent accidents
 - To avoid consequences after a fall

A little of nomenclature



What is already done?



Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 34 (2012) 485 – 490

**Procedia
Engineering**

www.elsevier.com/locate/procedia

9th Conference of the International Sports Engineering Association (ISEA)

Design of an instrumented bicycle for the evaluation of bicycle dynamics and its relation with the cyclist's comfort

Joachim Vanwalleghem^a, Frederik Mortier^a, Ives De Baere^a, Mia Loccufier^b,
Wim Van Paepegem^a

^aDepartment of Materials Science and Engineering, Ghent University, Zwijnaarde, Belgium

^bDepartment of Electrical Energy, Systems & Automation, Ghent University, Zwijnaarde, Belgium

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Abstract

Next to weight reduction and stiffness increase, increasing the cyclist's comfort has become an additional aspect in the design process of racing bicycles. Several attempts have been made to increase the shock absorption and damping capacity of a racing bicycle, but for the designer it is difficult to estimate the effect on the riding quality of the bicycle and whether the comfort perception of the cyclist increases. This work proposes an experimental test setup for quantifying comfort during outdoor field testing including real time data acquisition and storage from 16 sensors. This data is analysed by means of the whole-body and hand-arm vibration method and the absorbed power method. The initial test results show that the absorbed power method seems to correlate best with the cyclist's comfort. This method does not take acceleration data into account (as in the whole-body and hand-arm vibration method), but the combination of contact force and contact velocity is used for analysis.

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What is already done? (II)



*Using an Instrumented bicycle to help
understand cyclists' perception of risk*

H. Etemad, S.B. Costello and D.J. Wilson

Page 0

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

H. ETEMAD¹, S.B. COSTELLO¹ and D.J. WILSON¹

¹*Department of Civil and Environmental Engineering, The University of Auckland, Private Bag
92019, Auckland, 1142, New Zealand.*

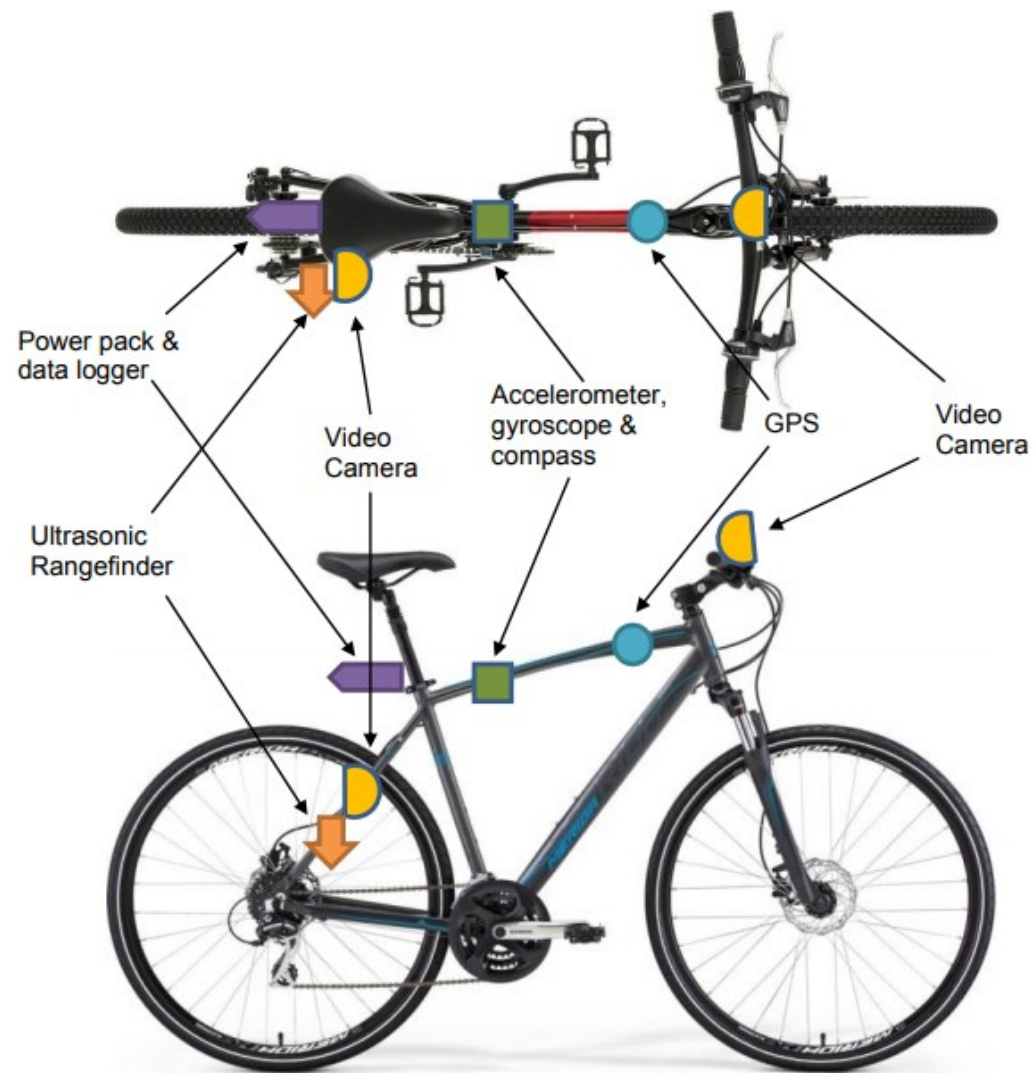
ABSTRACT

Cycling provides a wide range of benefits compared to motor vehicles. These benefits include health benefits from physical activity, environmental benefits, reduced traffic congestion and associated economic benefits. Not surprisingly, many countries actively encourage people to use bicycles as an alternative mode of transport to the motor vehicle.

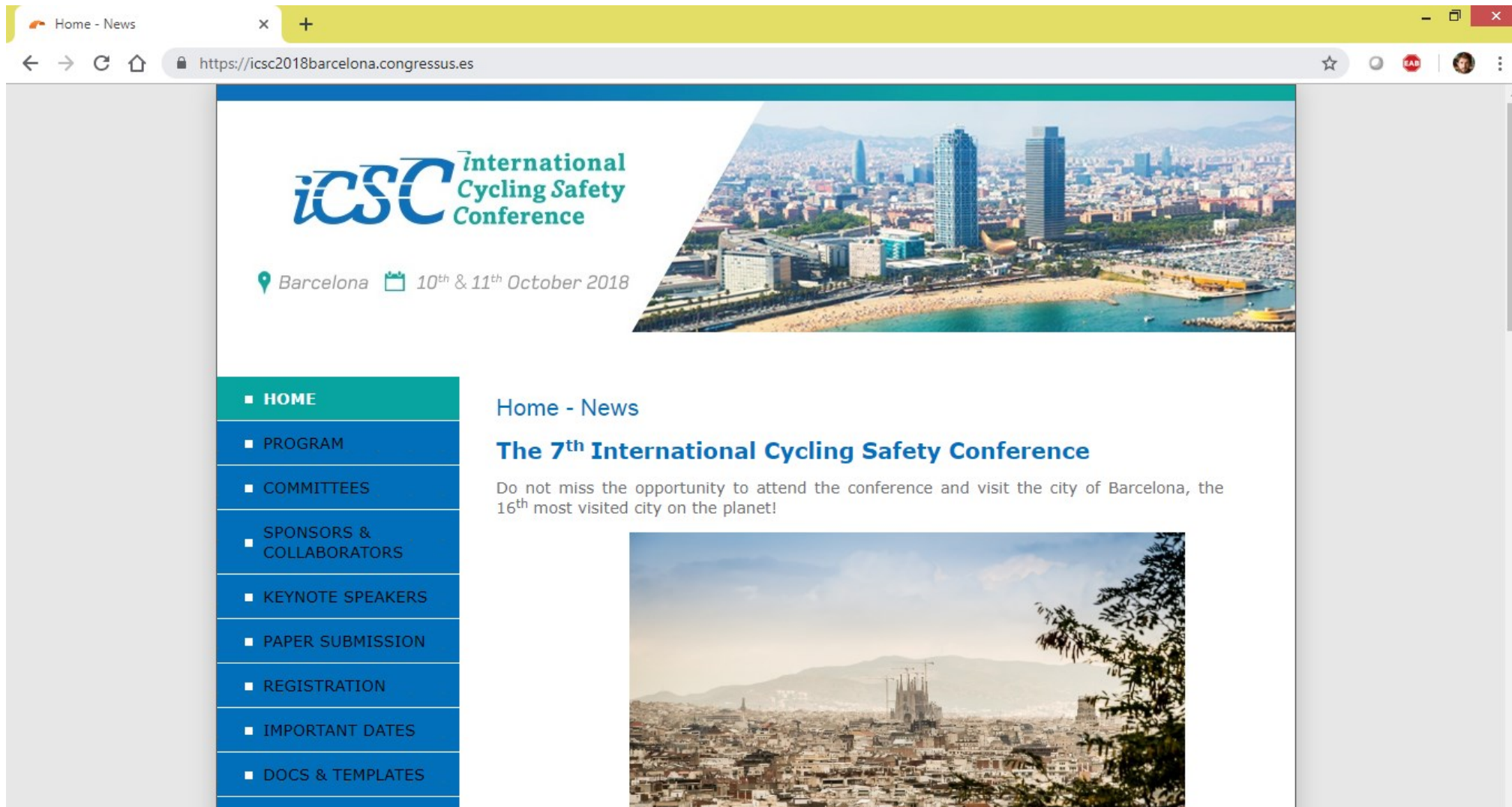
The road environment for cyclists affects their safety. For example, the absence of bicycle facilities along roads forces cyclists to travel in the roadway, often leading to a higher cyclist crash risk. In addition, bicycles have a much lower level of protection and stability by comparison with motorized 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 currently underway 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. This paper will discuss the methodology to be adopted in general, followed by a detailed description of the bicycle mounted instrumentation to be used in the research.

What is already done? (III)



What is already done? (IV)



The screenshot shows a web browser window with the URL <https://icsc2018barcelona.congressus.es>. The page features a navigation menu on the left with the following items: HOME, PROGRAM, COMMITTEES, SPONSORS & COLLABORATORS, KEYNOTE SPEAKERS, PAPER SUBMISSION, REGISTRATION, IMPORTANT DATES, and DOCS & TEMPLATES. The main content area includes a header with the ICSC logo and the text "International Cycling Safety Conference", a location tag for Barcelona, and dates for the 10th and 11th of October 2018. Below this is a large image of a Barcelona cityscape. The main heading is "Home - News" followed by "The 7th International Cycling Safety Conference". A text block encourages attendance, stating "Do not miss the opportunity to attend the conference and visit the city of Barcelona, the 16th most visited city on the planet!". A smaller image of Barcelona with Sagrada Família is shown below the text.

Home - News

<https://icsc2018barcelona.congressus.es>

icsc International Cycling Safety Conference


Barcelona 10th & 11th October 2018

- HOME
- PROGRAM
- COMMITTEES
- SPONSORS & COLLABORATORS
- KEYNOTE SPEAKERS
- PAPER SUBMISSION
- REGISTRATION
- IMPORTANT DATES
- DOCS & TEMPLATES

Home - News

The 7th International Cycling Safety Conference

Do not miss the opportunity to attend the conference and visit the city of Barcelona, the 16th most visited city on the planet!

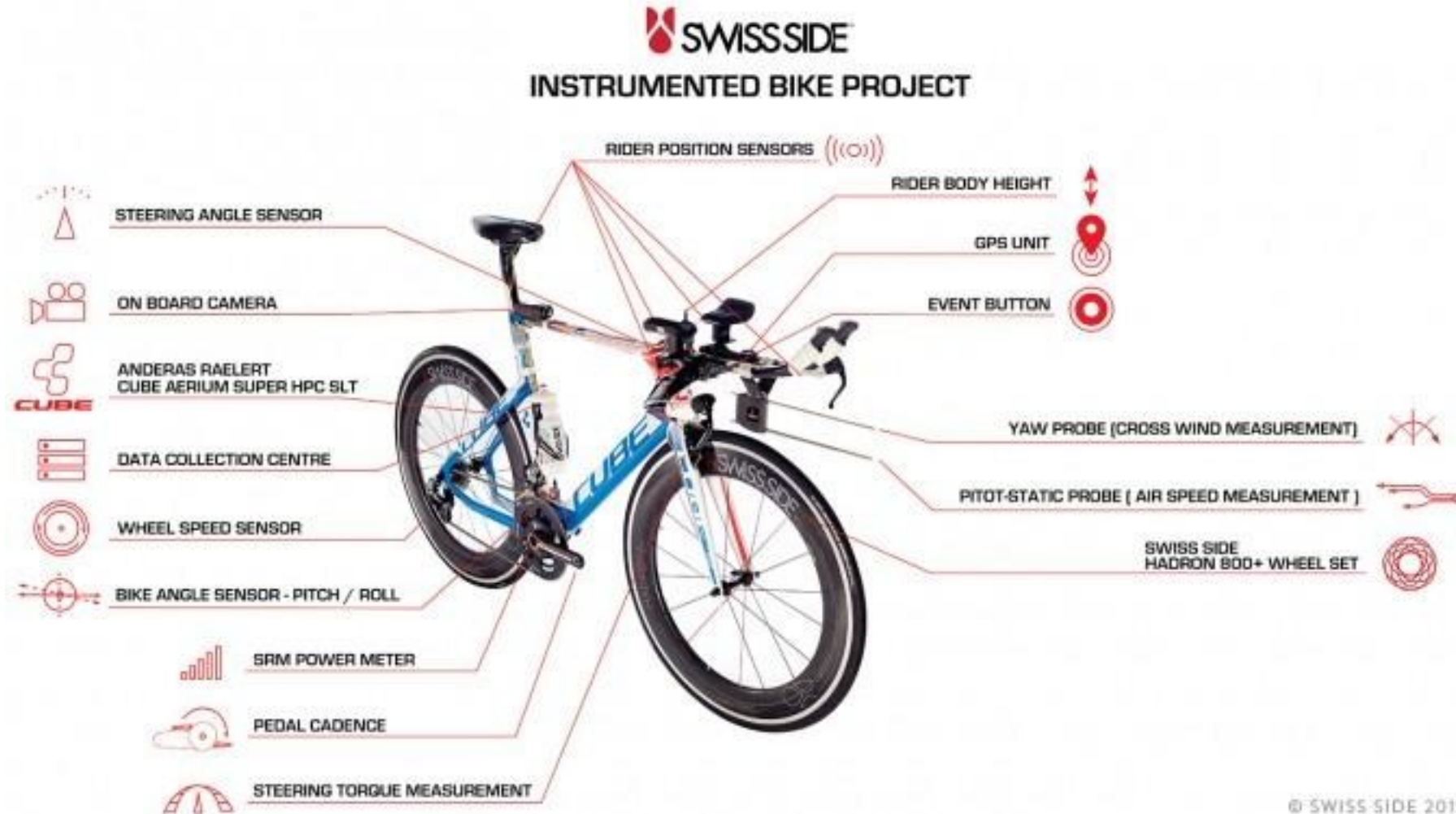




What is already done? (V)

The screenshot shows a web browser window displaying a ResearchGate publication page. The browser's address bar shows the URL: https://www.researchgate.net/publication/287782365_How_do_drivers_overtake_cyclists. The ResearchGate header is teal and includes a search bar, navigation links for 'Recruit researchers', 'Join for free', and 'Login', and a 'Discover by subject area' button. Below the header, there are links for '11 Citations', '38 References', and '7 Figures', along with buttons for 'Download citation', 'Share', and 'Download full-text PDF'. The main title of the article is 'How do drivers overtake cyclists?'. Below the title, it is identified as an 'Article (PDF Available)' in the journal 'Accident Analysis & Prevention', Volume 88, March 2016, pages 29-36, with 528 reads and a DOI of 10.1016/j.aap.2015.12.008. A 'Cite this publication' link is also present. The authors listed are Marco Dozza (Chalmers University of Technology), Ron Schindler (Chalmers University of Technology), Giulio Bianchi Piccinini (Chalmers University of Technology), and Johan Karlsson (Autoliv Development AB). The 'Abstract' section begins with the text: 'In Europe, the number of road crashes is steadily decreasing every year. However, the incidence of bicycle crashes is not declining as fast as that of car crashes. In Sweden, cyclists are the most frequently injured road users. Collisions between bicycles and motorized vehicles are of particular concern because the high speed and large mass of motorized vehicles create a high risk of serious injury to cyclists. In Sweden's urban areas, bicycle lanes keep bicycles separated from motorized vehicles, but on rural roads bicycle lanes are often absent, requiring drivers to interact with cyclists—usually by overtaking them. During this maneuver, drivers regulate speed and lateral position, negotiating with potential oncoming traffic to stay within their comfort zones while approaching and passing cyclists. In this study an instrumented bicycle recorded 145 overtaking maneuvers performed by car and truck drivers on public rural roads in Sweden. The bicycle was equipped with a LIDAR and two'.

What is already done? (VI)



To differentiate

- › City bike
- › Night drive
- › Pedestian
- › Road analysis
- › Parked car analysis
- ›

Available sensors from INFINEON

← → ↻ 🏠 <https://www.infineon.com/cms/en/product/>



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Power	> Sensor
ASIC	> 3D Image Sensor REAL3™
Automotive System IC	> Magnetic Position Sensor
ESD and Surge Protection	> Magnetic Speed Sensor
HiRel	> Magnetic Current Sensor
Microcontroller (MCU)	> Integrated Automotive Pressure Sensor
RF & Wireless Control	> Radar Sensor ICs
Security & smart card solutions	> Barometric pressure sensor for consumer applications
Sensor	> MEMS Microphones
Transceivers	> Lidar Sensors
Transistor & Diode	

Brainstorming

LEDs

- Road lighting
- Car driver warning
 - Severity in a Fall

Security

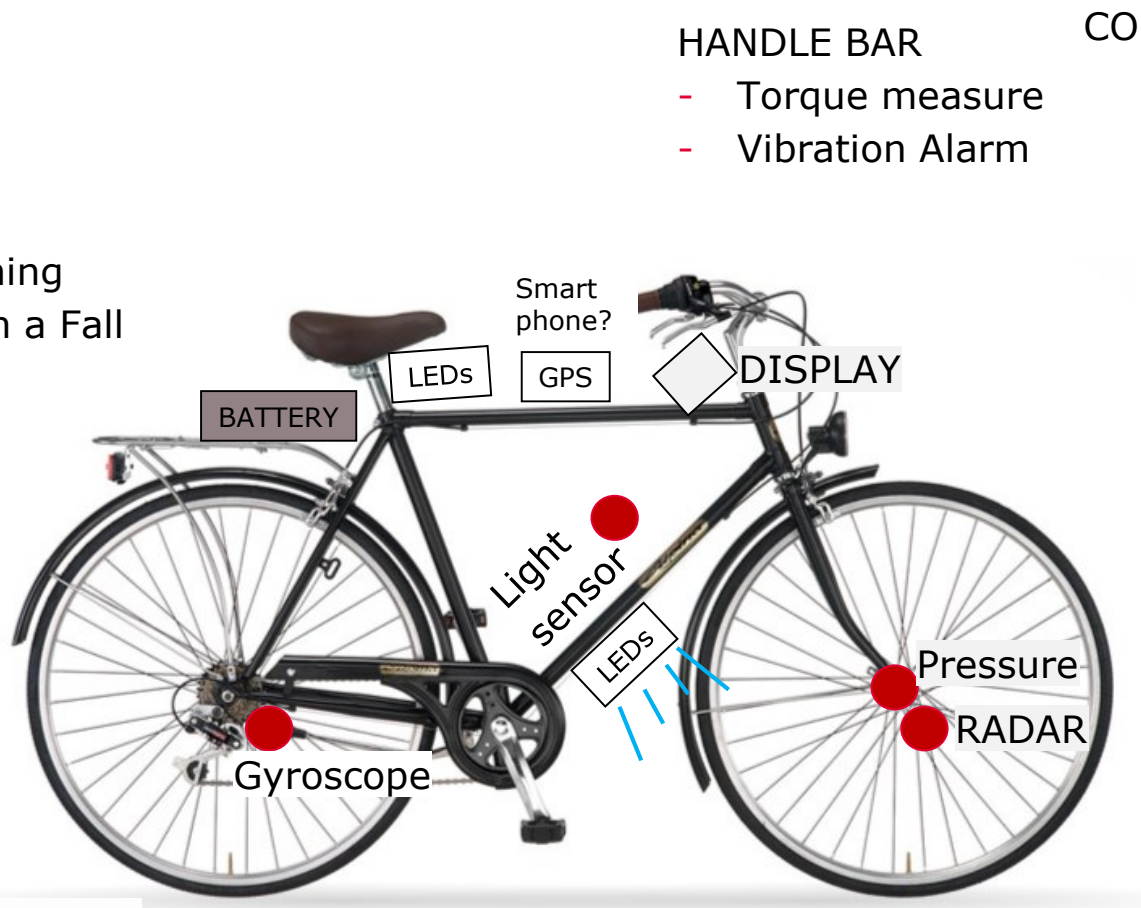
- Anti-robbery
- Anti-thief

Recovery

- After crash
- Smart phone

Helmet

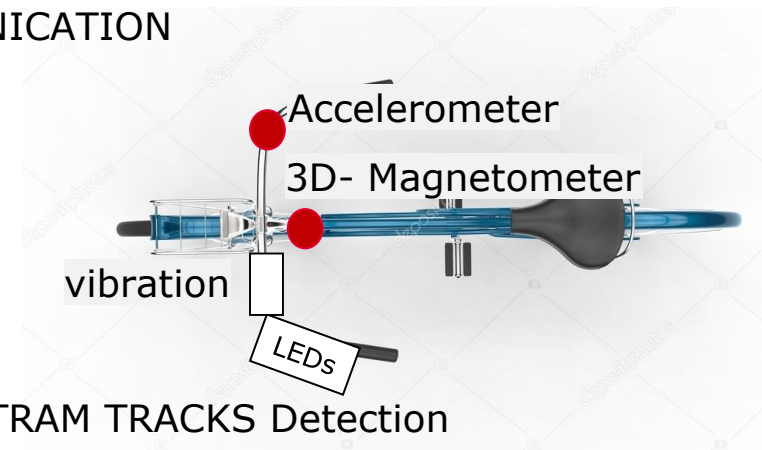
- Direction



HANDLE BAR

- Torque measure
- Vibration Alarm

COMMUNICATION



TRAM TRACKS Detection

- Recognition
- Knowledge (maps)
- Learning

DISPLAY

- INFORMATION

WHEEL

- SPEED CONTROL
- PRESSURE (low/anomalous)
- POSITION

The plan (estimated)

› 3 steps

1. To create a common background of basic functionalities of the board (4 weeks)

- TEAM WORK - Libraries to be shared
- Continue brainstorming on sensing
- ✓ **BUTTONS / LEDS / TIMERS (1 week, all together)**
 - Sub groups (3 weeks)
- SPEAKER
- ETHERNET
- DISPLAY
- GPIO CONTROL + Extra boards

2. Sensors DATA FUSION (4 weeks)

- Individual development of sensor functionalities related to the instrumented byke
- VIDEO of a DEMO!!!

3. Byke prototype (6 weeks)

- Final demo

Sub-groups

- SPEAKER

- Alessandro Rosso
- Sergio Mazzola
- Franco Ruggeri
- Lorenzo Zaia

- ETHERNET

- Rinaldo Clemente
- Enrico Loparco
- Dario Ciaudano
- Giulia Milan
- Talaye Talakoobi

- DISPLAY

- Amir Boroufar
- Samuele Yves Cerini
- Giulio Alfarano
- Andrea Calabrese
- Damiano Fisicaro

- GPIO CONTROL + Extra boards

- Zubair Ahmed Junaid
- Luca Barbisan
- Luca Rodi
- Gabriel Alejandro Fraire
- Ayman Hatoum

Milestones and next meetings

› MEETINGS

- Tuesday 12 March - 8:30 (ACS LAB)
- Friday 5 April – 14:30 (ACS LAB)

› ACS LAB could be booked every week on

- Tuesday 8:30 – 10:00
- Friday 14:30 – 16:00
- TO BE CONFIRMED

› MILESTONES

1. BUTTONS / LEDS working (LIB released)
2. SUB-GROUPS goals (LIB released)

› WEBSITE

- News outside
- Inside sharing of resources
- WebMasters
 - Rinaldo Clemente, Sergio Mazzola