

Using Smartphones to Monitor Cycling and Automatically Detect Accidents - Towards *eCall* Functionality for Cyclists

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Background –Post-crash safety

- How to minimize the consequences of accidents?
- Prompt treatment saves lives and mitigate injuries
- Up to a third of trauma mortalities can be saved¹
- Swift dispatch of suitable competences and equipment
- Quick response requires immediate knowledge of accident and its exact location
- *eCall*: automatic alarm with GPS location

1. James et al. “An analysis of prehospital deaths: Who can we save”
Journal of Trauma and Acute Care Surgery 77: 213-218, 2014.

eCall

Deployment of the eCall in-vehicle system: extracts from the vote on the report by Olga SEHNALOVÁ (S&D, CZ)

report SEHNALOVÁ A7-0106/2014

Legislative resolution

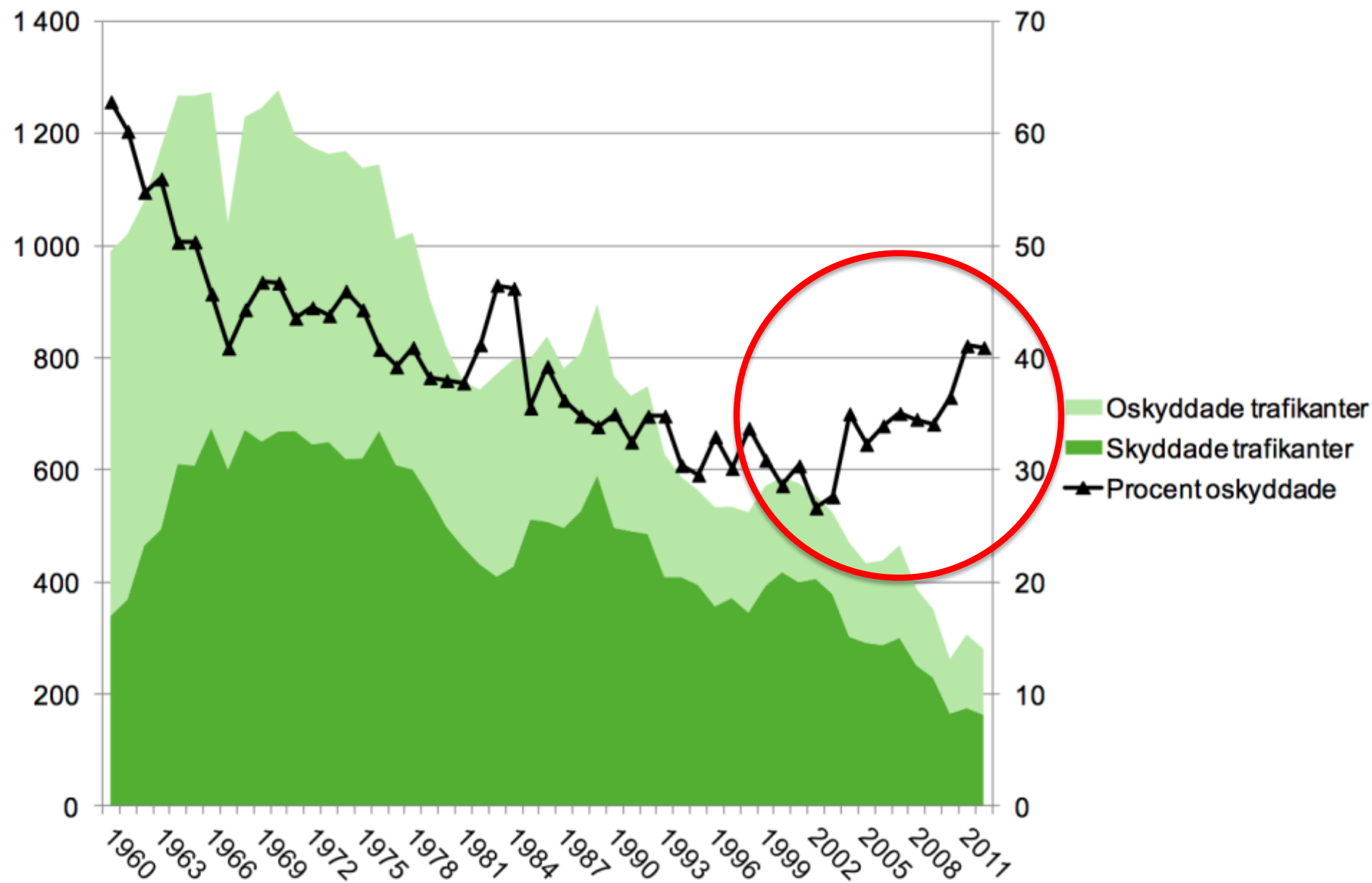
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- 8/10 bicycle accidents are single accidents¹
- *eCall* most useful in rural areas
- Many case reports of victims found late



Bild: Scanpix, hitta.se

Kvinna dog i cykelolycka - hittades i dike

Hittades i ett dike av privatperson på fredagsmorgonen.

En 62-årig kvinna omkom på fredagsmorgonen i en singelolycka med cykel på Gråbovägen.

Kvinnan hittades vid halv åtta-tiden på morgonen av en privatperson som såg henne ligga medvetlös i diket vid korsningen Gråbovägen-Vippärtsvägen.

Poliserna som var först på platsen efter larmet kunde konstatera att kvinnan var avliden.

- Vi tyckte först att det såg konstigt ut på platsen, med bromsspår på Gråbovägen strax intill där kvinnan hittades. Vi spärrade därför av platsen och tillkallade tekniker, säger polisen presstalesman Christer Fuxborg.

Poliserna på platsen avskrev smitningsmisstankarna.

- Teknikerna konstaterade att kedjan på kvinnans cykel hoppat av och förmodligen orsakat att hon kört omkull. Tillkallad läkare konstaterade att hon slagit huvudet i marken och avlidit av detta, trots att hon hade hjälm på sig, säger Christer Fuxborg.

1. A. Niska and J. Eriksson, "VTI rapport 801: Statistik över cyklisters olyckor - Faktaunderlag till gemensam strategi för säker cykling," 2013.

eCall for vulnerable road users





Advantages with using smartphones as a tool for *eCall*

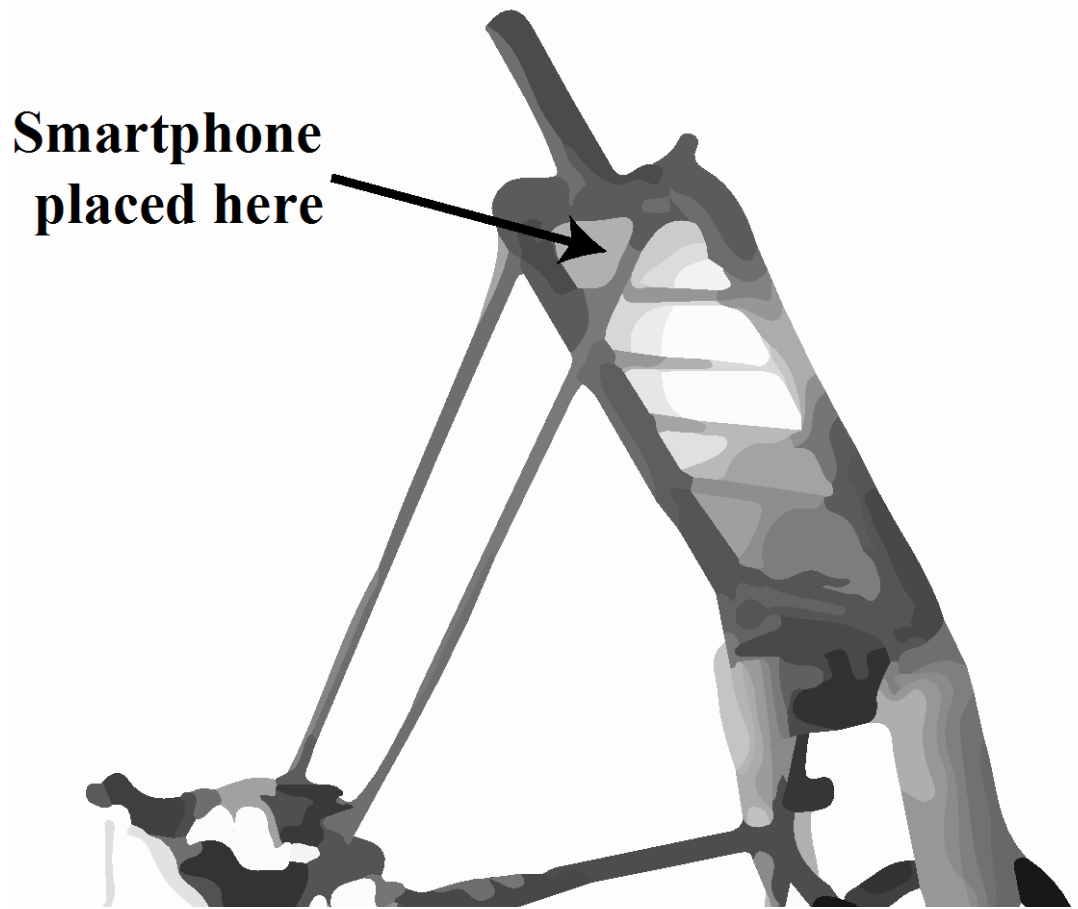
- Sensors in modern smartphones are of rather high quality (battery consumption has been reduced)
- No need to install additional hardware
- Focuses on the user
- Potential to reach a large number of people in short time

Method

- Smartphone: Google Nexus 4
 - Combined six-axis accelerometer and gyro chip (InvenSense Inc. MPU- 6050, San Jose, CA, USA)
 - Acceleration (100 Hz), rotation (100 Hz), position (GPS, 1 Hz)
- Collection of normal data, 5.5 hours
 - Regular commuting
 - Specific tests (standing, spurting, passing over high/sharp edges)
 - Variation of bike types, phone placement, users, etc.

Crash data

Smartphone
placed here

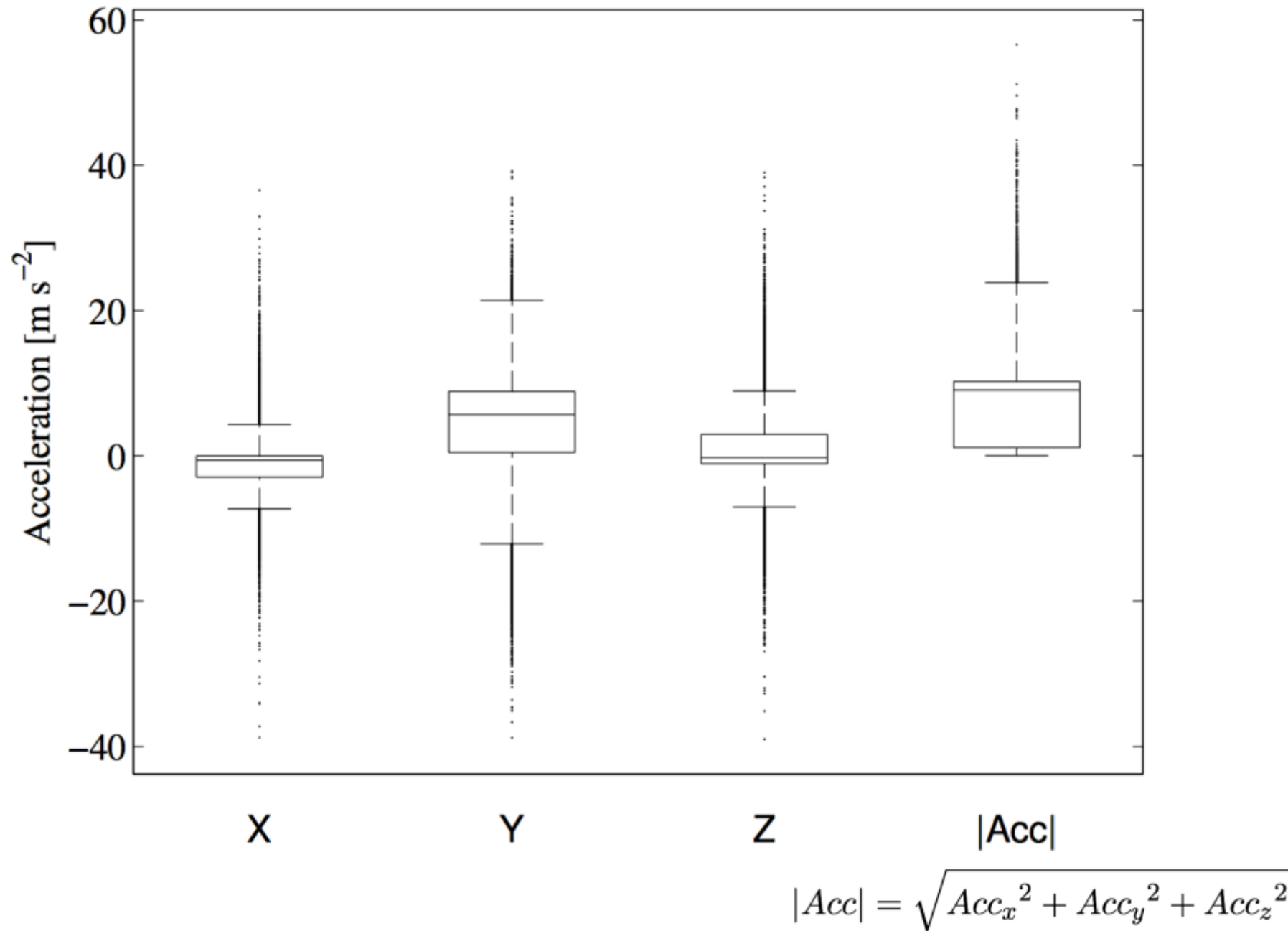


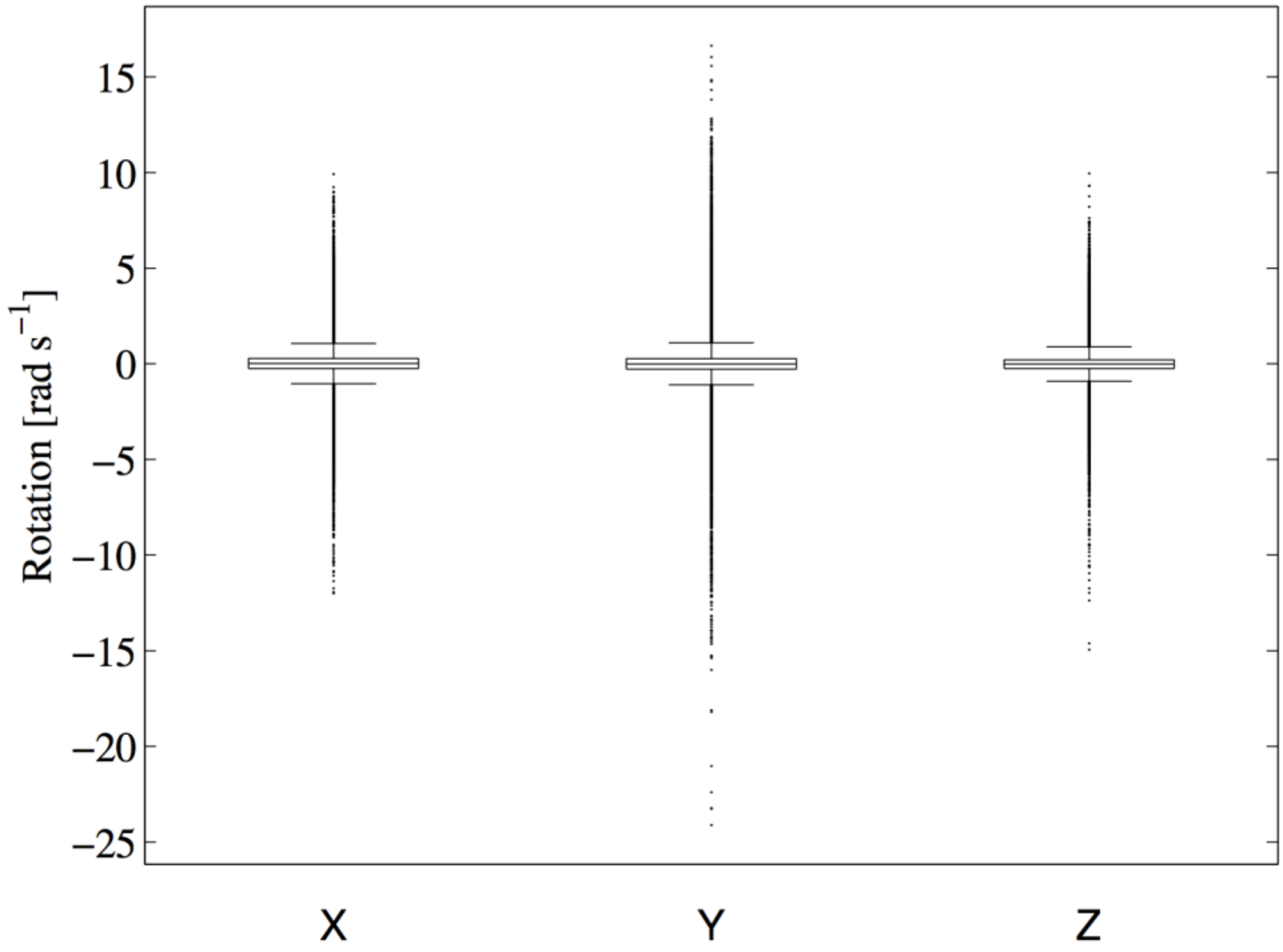
Crash number	Description
1	Dummy overturned at low speed on soft surface
2	Dummy overturned at medium speed on soft surface
3	Dummy crashed into rigid object at low speed and overturned on soft surface
4	Dummy overturned at medium speed on a hard surface
5	Dummy crashed into rigid object at low speed and overturned on a soft surface
6	Dummy overturned at very low speed on a hard surface

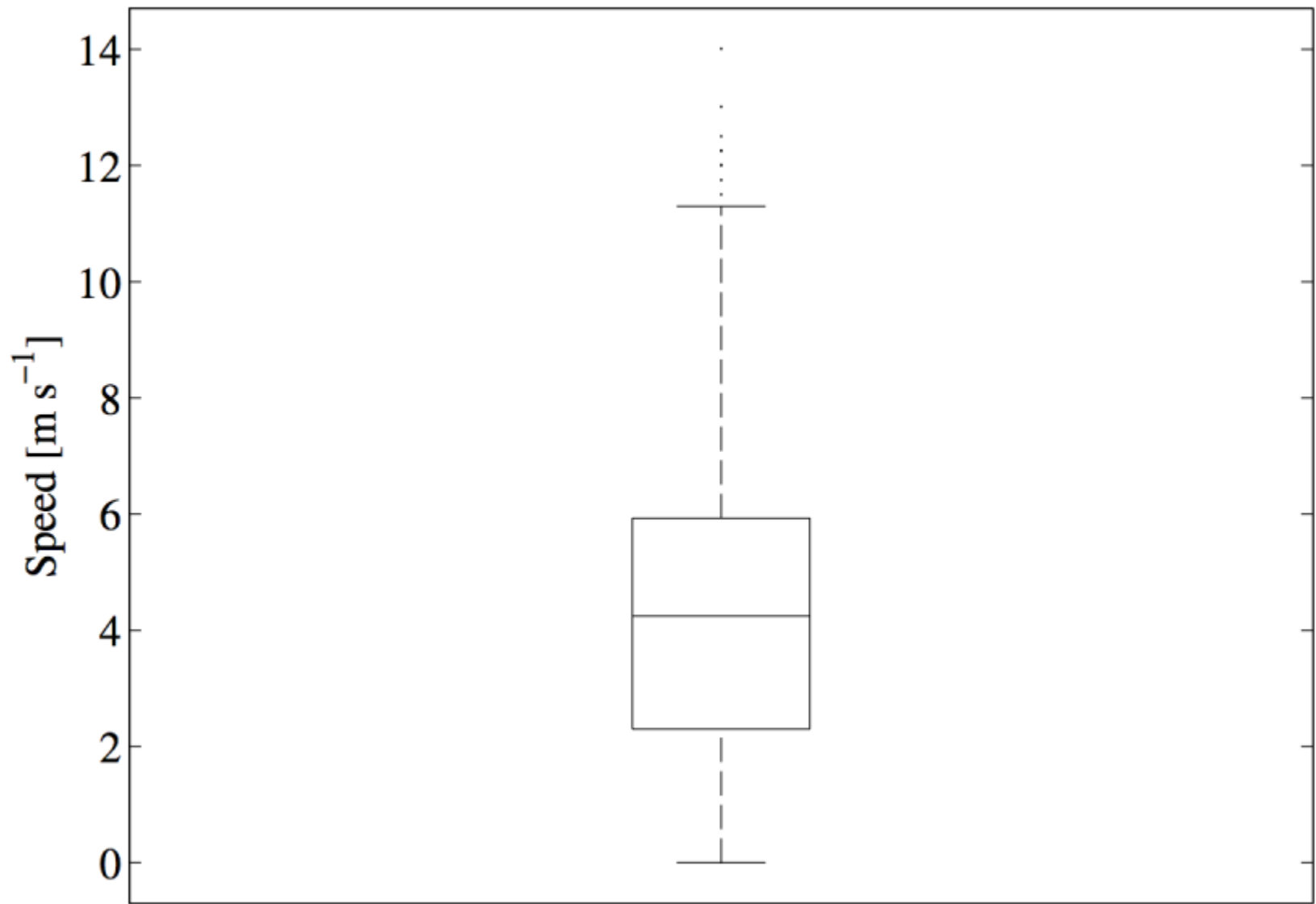
Crash Detection Algorithm

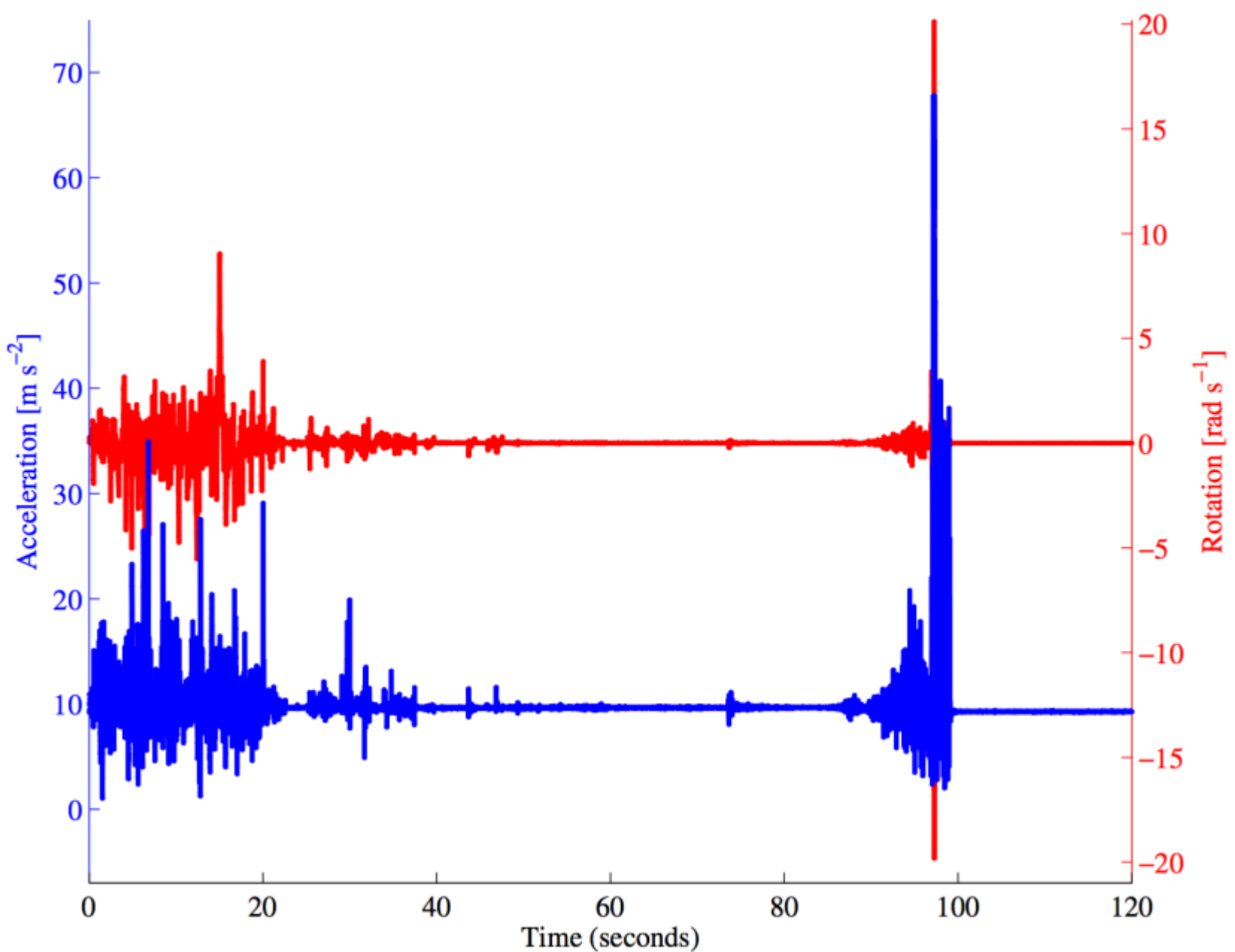
- Uses a combination of criteria for acceleration, rotation and speed
- Developed in collaboration with Jalp Systems AB
- Evaluated on the normal and crash data
- Further evaluated on many hours of normal cycling data (prospectively)

Results









- All crashes could be detected with no false positives

Limitations

- Limited amount of data
 - However, many different situations covered
- Few crash tests with a simplified crash model
 - Further studies using more realistic models needed

Thanks for your attention!

Questions?

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