Driver Coach

A driving coach for everyone
to make driving safer

Sharing information to reduce traffic accidents

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  - Purpose and scope of this presentation
- Traffic accidents don't just happen, the have causes
- Vehicle Driving Safety monitoring system
  - Distracted driving and dangerous behaviour increase risk
  - How to identify and prevent risky situations
  - Providing feedback to driver to reduce accidents
- Road safety ECO system
  - Multi party information sharing can make driving safer
  - Signalling dangerous situations without fear for repercussion
  - How drivers and organisations work together to make driving safer
- What to do next

feedback

Personal driver coach

Purpose and scope of this presentation

- To provide insights
- To show what is possible
- To start a discussion
- To inspire
- To move you into action

- It's an active working document
- It's part of a greater project
- This is not a design poured in concrete
- Its open for discussion

We need your expertise to make it happen

What really matters in life

Safety

Privacy

Transparency

Trust

If you are honest, truthful, and transparent, people trust you. If people trust you, you have no grounds for fear, suspicion or jealousy.

— Dalai Lama —

AZ QUOTES

We all have our own responsibility to take action

What we can learn from near misses

Small errors, mistakes and dangerous behaviour are predictors for more serious events.

We should keep track of every incident (no matter how small) and learn from it.

We should be more aware of our own behaviour. This may feel intrusive but injuries hurt a lot more!

Fatal injuries

Major injuries

Minor injuries

Near misses

Small errors, mistakes, dangerous driving

Cost & Impact

Causes of near misses

The chart below shows some of the top behaviors

and how they contribute to near collisions
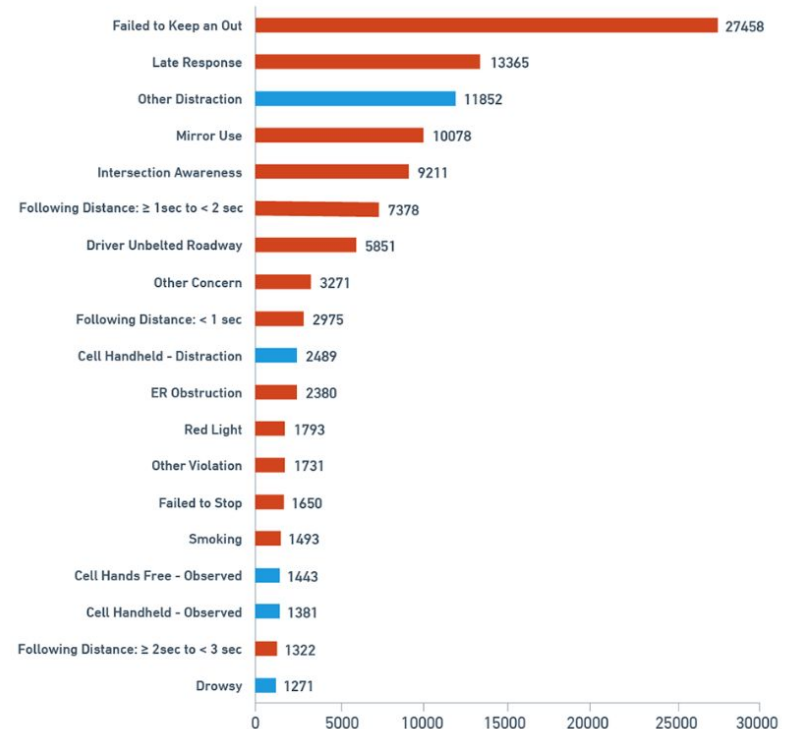
most causes are caused by the driver

we can measure and detect most causes

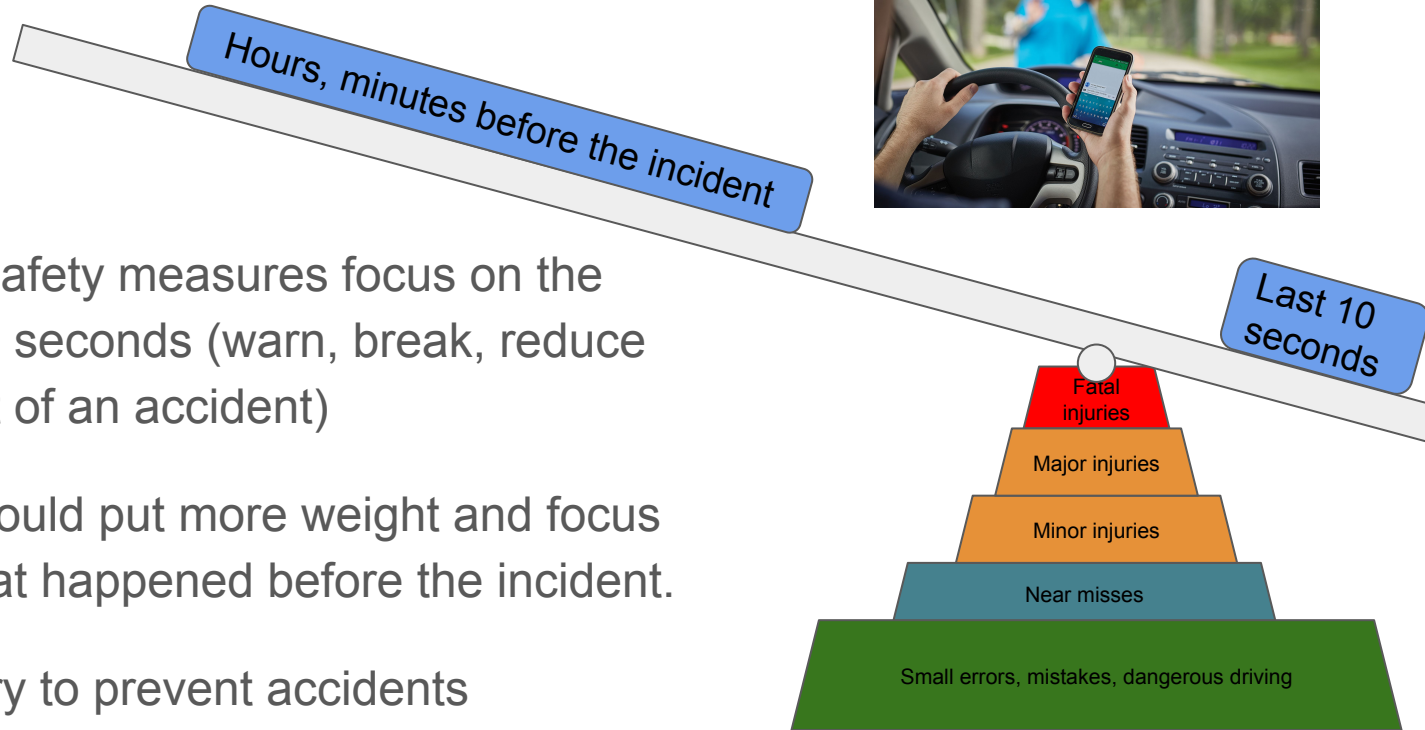we can provide feedback to the driver

the driver can stop making errors

therefore we can reduce the risk of accidents

What would happen if we reduce some of these causes?

Failed to Keep an Out	27458
Late Response	13365
Other Distraction	11852
Mirror Use	10078
Intersection Awareness	9211
Following Distance: ≥ 1sec to < 2 sec	7378
Driver Unbelted Roadway	5851
Other Concern	3271
Following Distance: < 1 sec	2975
Cell Handheld – Distraction	2489
ER Obstruction	2380
Red Light	1793
Other Violation	1731
Failed to Stop	1650
Smoking	1493
Cell Hands Free – Observed	1443
Cell Handheld – Observed	1381
Following Distance: ≥ 2sec to < 3 sec	1322
Drowsy	1271

Can we prevent accidents from happening?

Hours, minutes before the incident

Most safety measures focus on the last 10 seconds (warn, break, reduce impact of an accident)

We should put more weight and focus on what happened before the incident.

Let's try to prevent accidents

Last 10 seconds

Decrease fatalities

Fatal injuries

Major injuries

Minor injuries

Near misses

Small errors, mistakes, dangerous driving

You drive the same road every day

- You know it by heart
- Every turn
- Every tree
- Nothing special
- That's when you start day dreaming

"It came out of nowhere!"

We are all perfect drivers, but

We sometimes forget what we have learned

We are so hungry

We are so busy

We get tired

It came out of nowhere

So human, so busy, totally unaware

This results in Road Accident Statistics

According to the British Royal Society for the Prevention of Accidents, driver fatigue contributes up to 20% of road accidents and up to a quarter of fatal and serious accidents. The statistics are that an estimated 1,550 deaths, 71,000 injuries, and $12.5 billion in monetary losses each year due to driver fatigue. ………..
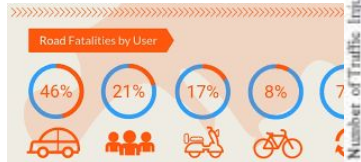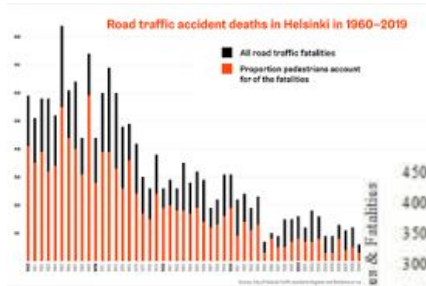
...s ranging from
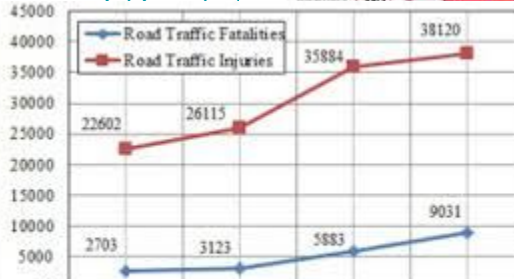
I don't want to end up in those statistics

We are all perfect drivers, but

Research

- We miss what happens around us
- By tracking head and eye movement we can evaluate our level of situational awareness

What are our major distractions?

Distractions	Resolutions

Distractions
1. We get distracted by our phone
2. We are hungry or tired
3. We get day dreaming

Resolutions
1. We should disable the phone
2. We should be in good physical shape
3. We should be focused

There are four types of driver distraction:

- Visual – looking at something other than the road.
- Auditory – hearing something not related to **driving**.
- Manual – manipulating something other than the steering wheel.
- Cognitive – thinking about something other than **driving**.

With so many potential distractions we tend to easily forget how we should drive safely. Hence we should be constantly reminded of that.

360 degree awareness

Good driving habits

- Wearing seat belt
- Active driving posture
- Hands on the steering wheel
- Looking in the general driving direction
- Checking for traffic from all directions
- Left/right/rear mirror checking
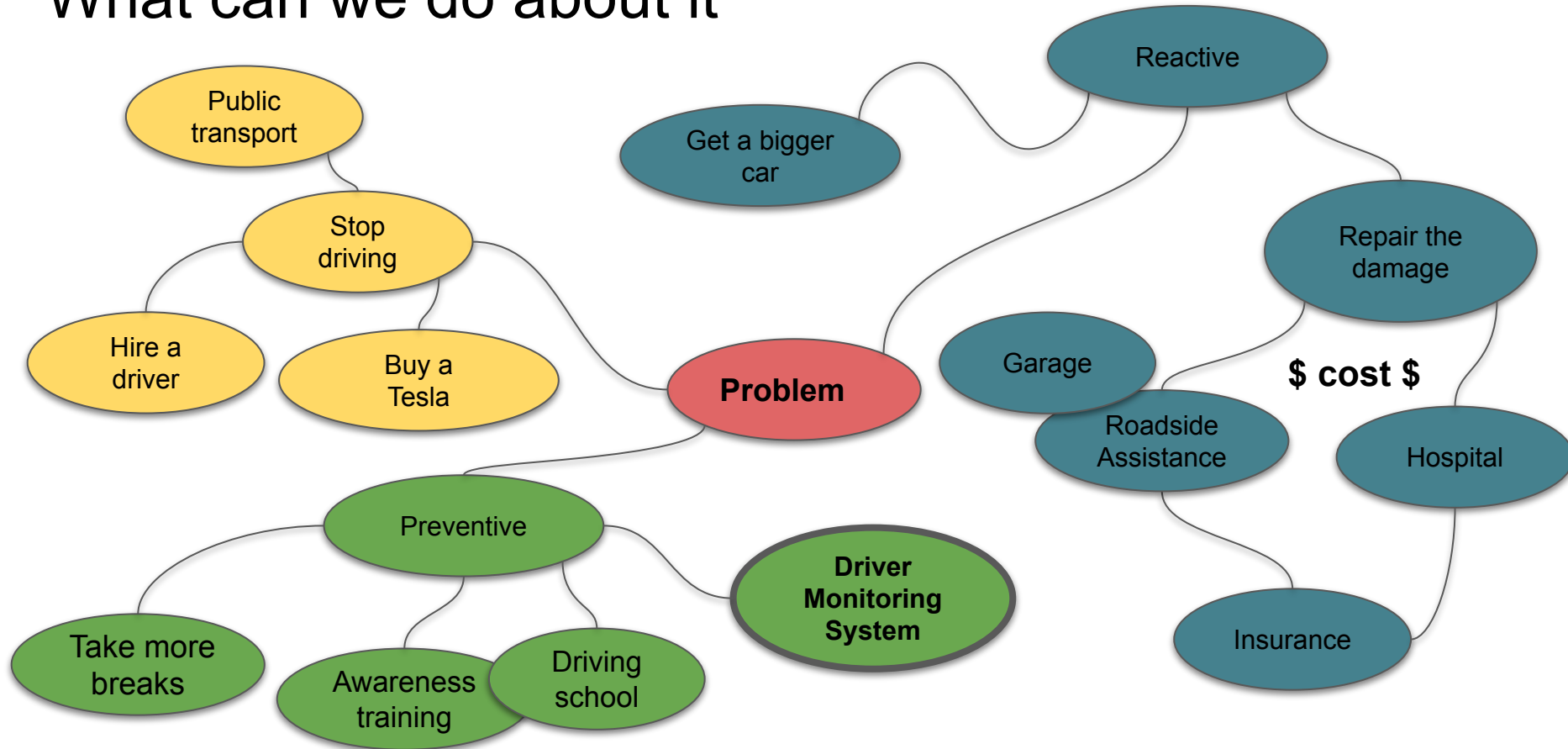- Signalling direction changes to other drivers
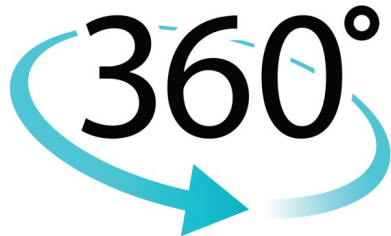
Bad driving habits

- Operating the console (NAV / media / airco)
- Talking to passengers
- Eating or drinking
- Other activities (reaching for something, singing)

Ugly driving habits

- Falling asleep
- Mobile phone usage (handheld, call, texting)

What can we do about it

Driver Monitoring System (drowsiness)

- Warns when driver is tired
- Detects only drowsiness
- Build-in in expensive cars
- Most regular cars don't have this feature
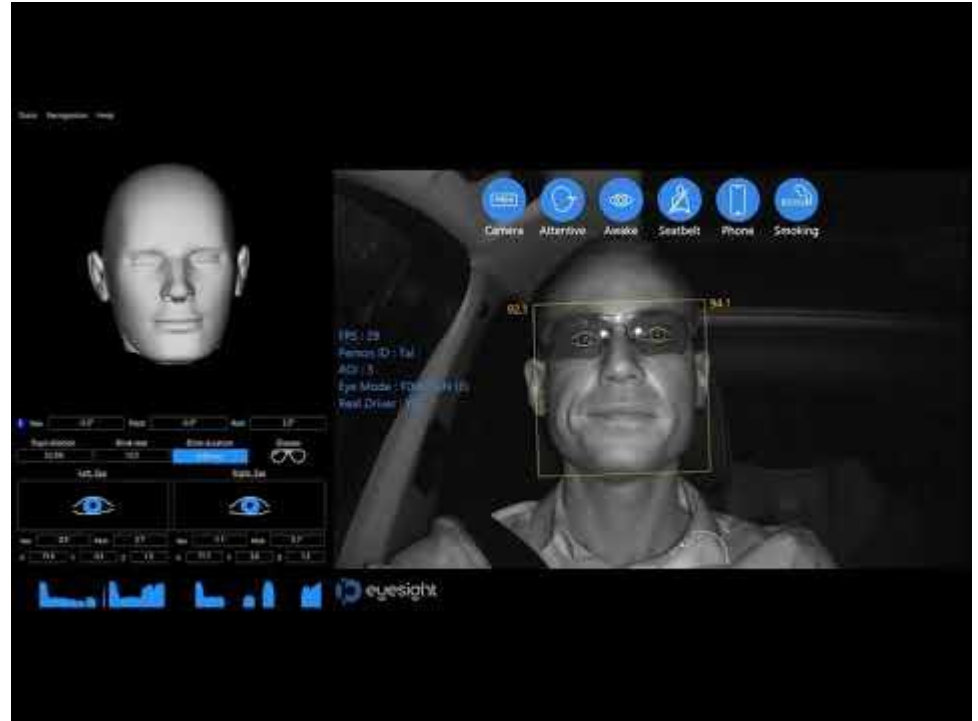- Effect on safety is limited

Driver Monitoring System (distractions)

Detects:

- Drowsiness
- Wearing a seatbelt
- Distractions
  - Holding a phone
  - Smoking

Effect on safety is better but still not complete

Driver Monitoring System (driving skills and style)

Fully automated system detects:

- Drowsiness
- Distraction
- Driving skills
    - Steering
    - Acceleration/ Deceleration
    - Braking (timing)
    - Gear (timing, gear selection)
- Driving style
    - Driver alertness
    - Mirror checking
    - Over the shoulder checking
    - Indicator lights usage
    - Stop signs / traffic lights
    - Right of way
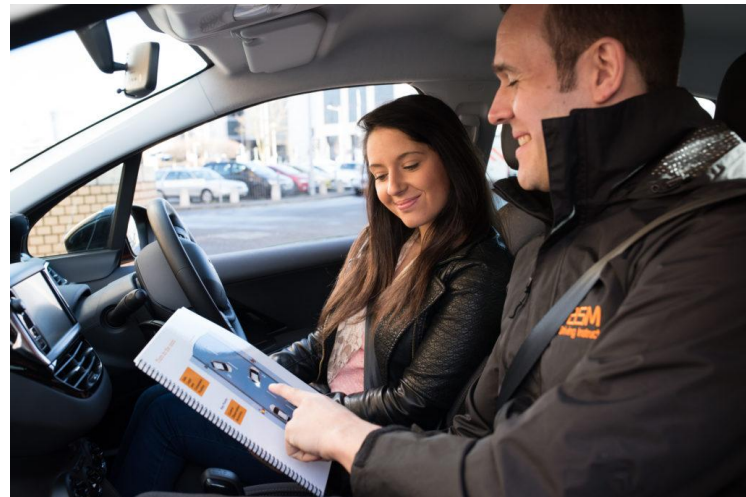
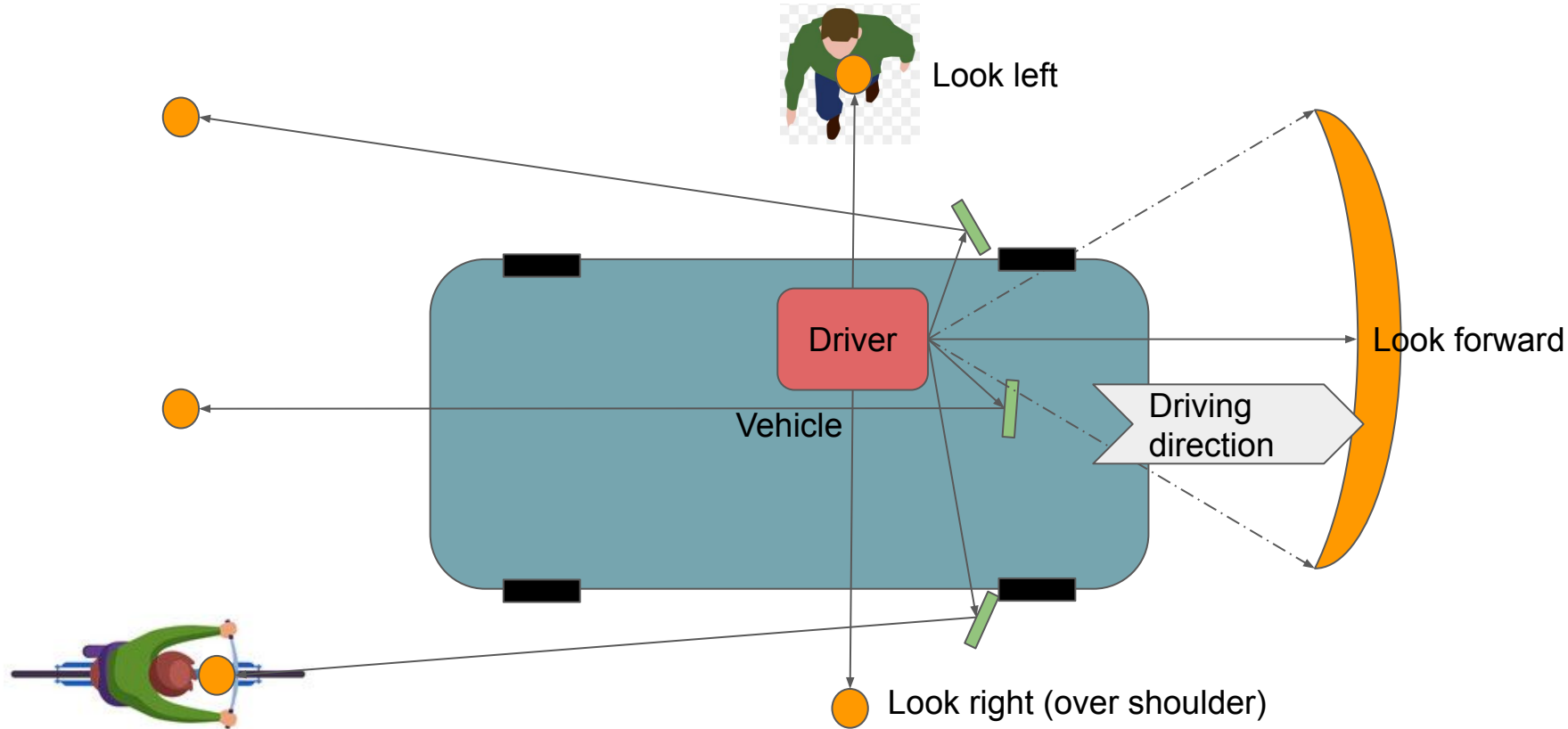Driver Coach: having a personal coach in your car can make driving safer

Example: making a proper left turn

- Assess the traffic situation
  - Allowed to do (legal, traffic rules)
  - Should i do (is it safe, sensible)
- Check rear mirror
- Use direction indicator lights
- Slow down
- Come to a full stop
- Watch out for other traffic
- When traffic allows
- Check side and mirrors
- Turn left

wikiHow to Make a Left Turn

Driver situational awareness

Look left

Look forward

Driver

Driving direction

Vehicle

Look right (over shoulder)

Provide feedback to the human in the loop
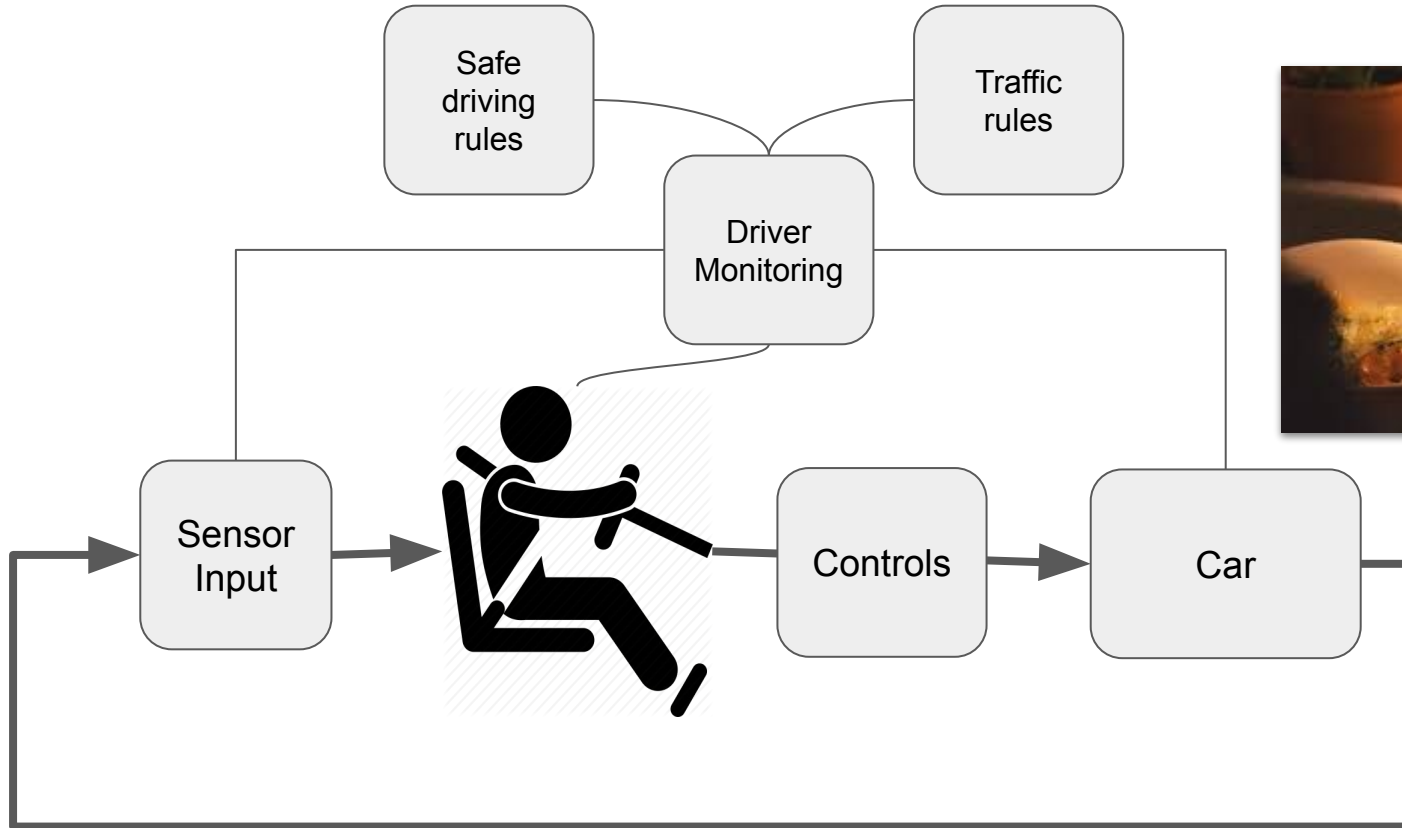
The 2ToDrive program (Netherlands)

Every year 300.000 young drivers get their driving license

2ToDrive allows 16 old to build up driving experience accompanied by a licensed driver

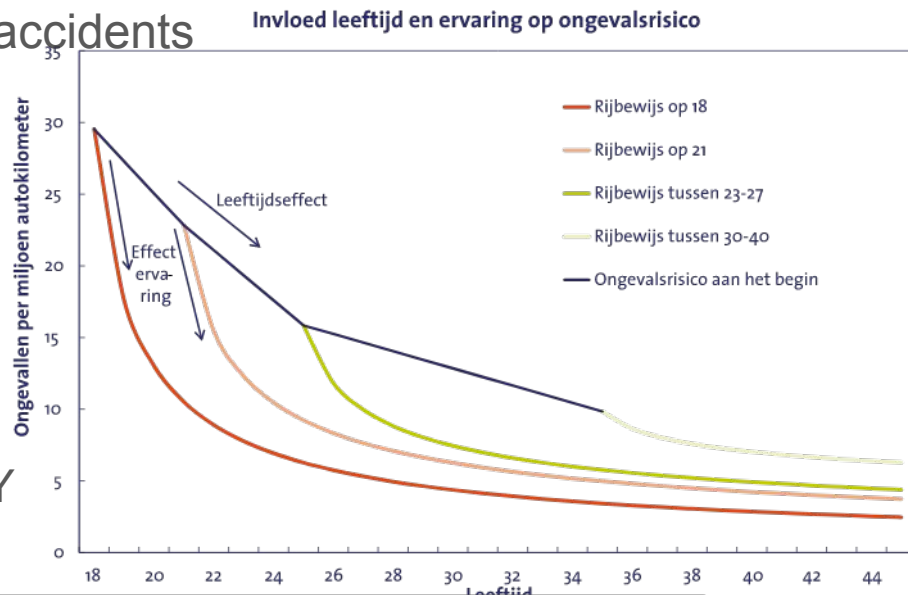| **16** *jr. theorie examen	**16** *jr. 1/2 praktijklessen + tussentijdse toets	**17** jr. praktijk examen	**18** jr. zelfstandig autorijden
Vanaf deze leeftijd mag je theorie examen doen.	Met of zonder theorie-certificaat mag je vanaf deze leeftijd rijlessen nemen.	Nadat je je rijbewijs hebt gehaald mag je vanaf deze leeftijd autorijden, onder begeleiding van een coach.	Vanaf deze leeftijd mag je zelfstandig autorijden, zonder coach.

Young Driver Coach

Every year 300.000 young drivers get their driving license

Young drivers (18-24) have higher risk of accidents

Driver Coach can help to

- Increase safety / reduce accidents
- Feedback / improve driving skills
- Increase peace of mind for parents

Parents lease driver coach device for 6M, 1Y

Invloed leeftijd en ervaring op ongevalsrisico

- Rijbewijs op 18
- Rijbewijs op 21
- Rijbewijs tussen 23-27
- Rijbewijs tussen 30-40
- Ongevalsrisico aan het begin

Leeftijdseffect

Effect erva-ring

Ongevallen per miljoen autokilometer (y-axis)
Leeftijd (x-axis)

Driver Coach: having a personal coach in your car can make driving safer

Dangerous driving

Every year 16.000 driver licenses revoked

- 12 to 15% caused by alcohol and drugs
- Dangerous driving (speeding)

Procedure

- License is revoked for a period of time
- Driver has to follow a course
- Driver gets license back
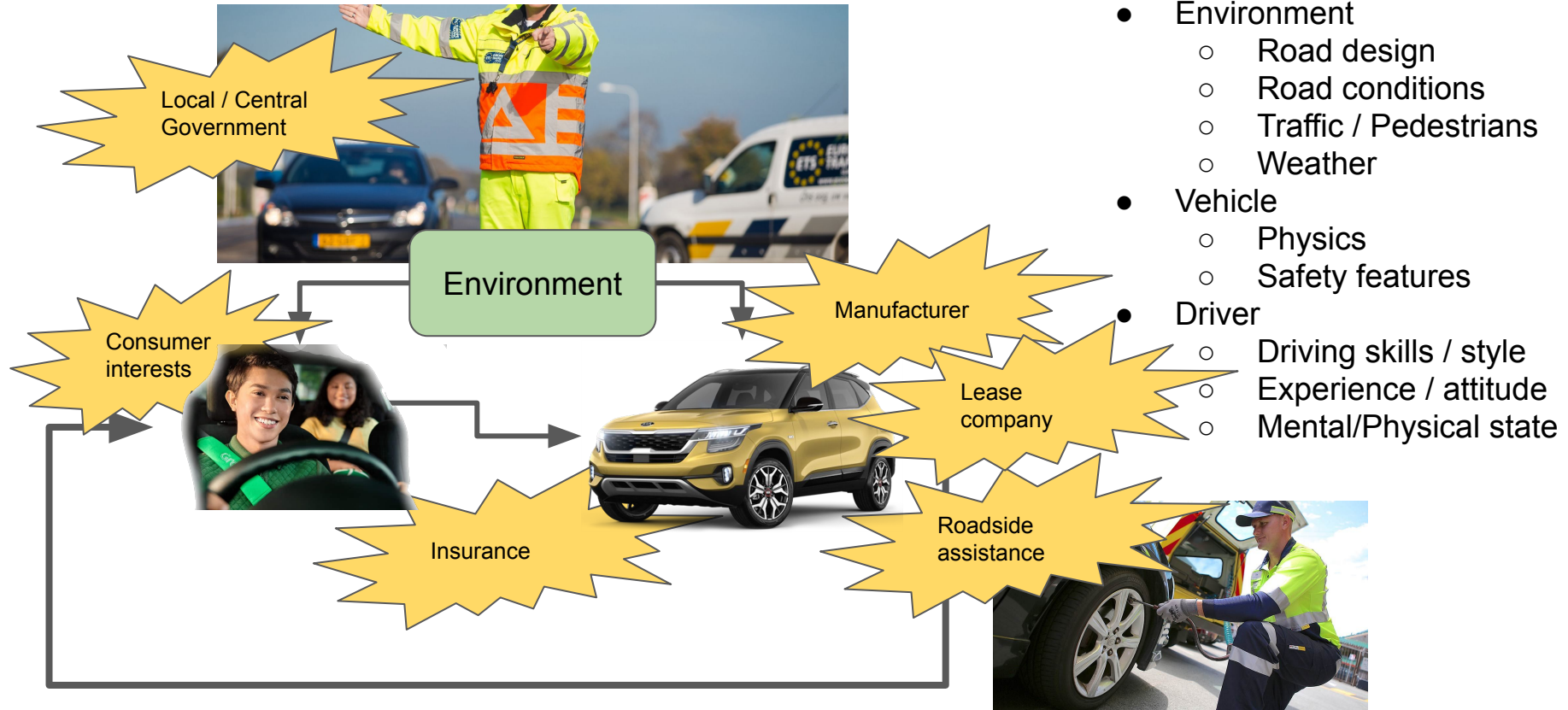- Driver is monitored for a period of time

Driver Coach: used as an electronic safety measure
to ensure driver keeps improving driving style and does not violate again

Let's take a step backward

And view it from a higher perspective

Vehicle driving ECO system

Local / Central Government

Consumer interests

Environment

Manufacturer

Lease company

Insurance

Roadside assistance

- Environment
  - Road design
  - Road conditions
  - Traffic / Pedestrians
  - Weather
- Vehicle
  - Physics
  - Safety features
- Driver
  - Driving skills / style
  - Experience / attitude
  - Mental/Physical state

Every vehicle can sense itself, its driver and its environment

Vehicle sensors collect data

- Vehicle
- Driver
- Road conditions
- Other road users

This data can provide valuable feedback

- Vehicle ⇒ traffic density, speed, environmental impact
- Driving style ⇒ improve your driving, reduce accidents, reduce insurance costs
- Road safety ⇒ unsafe situations, improve roads, make your neighborhood safer
- Oher road users ⇒ Detect near misses

Make driving safer by providing feedback to drivers, road owners and organisations

# Why should we share data and learn to trust each other

- Working together on a common goal
  - To make driving safer
  - To spot unsafe traffic situations
  - Raise driver awareness
  - Reduce number of traffic incidents
  - Because i want to make my neighborhood safer
  - To reduce cost for society as a whole
- We need to share data
  - To improve specific traffic situations (share data anonymously with local government)
  - To make vehicles safer (share driving data anonymously with car manufacturers)
  - To reduce insurance cost (share driving behaviour with insurance)
  - To improve my own driving style (calculate driving score and compare anonymously with other drivers)

Make driving safer by providing feedback to drivers, road owners and organisations

Reporting potential dangerous traffic situations

- Accidents / near accidents
- Dangerous driving
- Confusing traffic situations
- Obstacles
- Slippery roads
- Obstructed traffic signs
- Dysfunctional (bicycle) lights
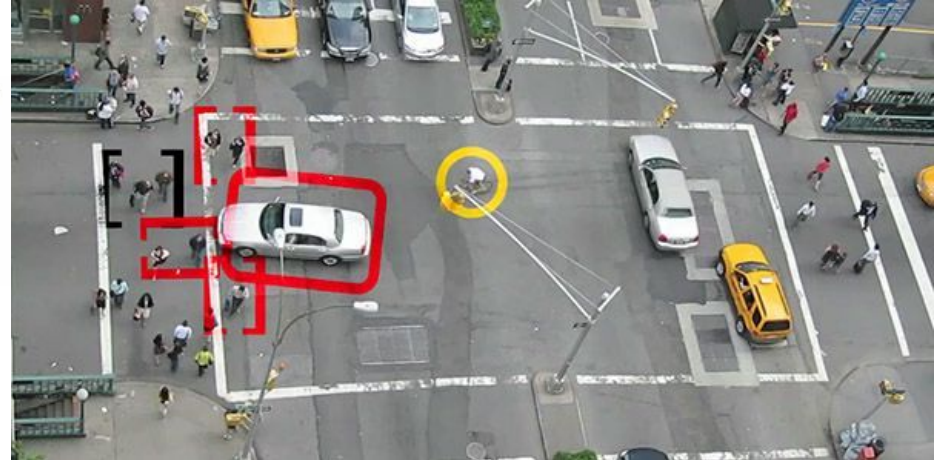
Anonymous reporting to gather road safety statistics for making driving safer, not for naming and shaming

Help the (local) government to improve road safety

- Report to (local) government
  - traffic infrastructure (road signs, dangerous junctions, road conditions)
  - dangerous driving situations
- Prerequisites
  - Anonymous reporting (no legal consequences)
  - Incentives (benefits, kudos, money)
- Goal:
  - Improve safety / faster repair
  - Lower cost (social impact, road inspections)
  - Open data (traffic safety, road quality)

Data ownership, privacy and mutual trust between parties are key

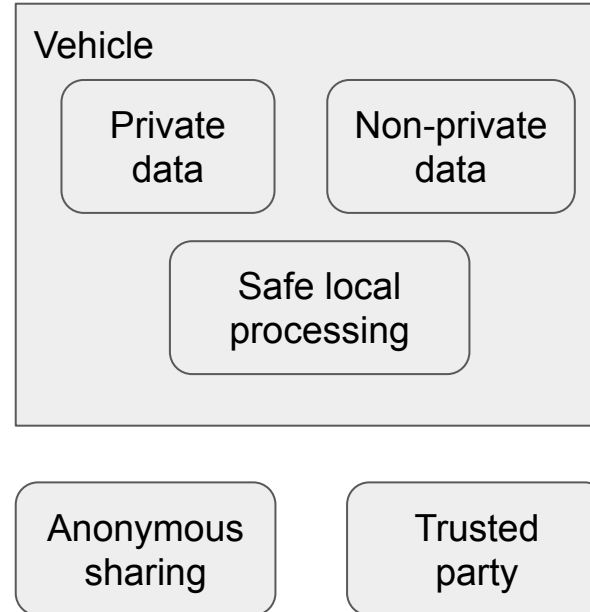# Share data with insurance / lease company

- Collect data on driving behaviour
  - Vehicle maneuvers
  - Driver behaviour
- Prerequisites
  - Privacy (GDPR minimize data)
  - Incentives (benefits, kudos, money)
- Goal:
  - Improve safety / less damage
  - Lower cost (social impact)
  - Common driver risk model
  - Open data (traffic safety, road quality)

Data ownership, privacy and mutual trust between parties are key

But how about security and privacy

- Requirements
  - Data ownership
  - Assured privacy
  - Driver in control
- Local data processing
  - calculate driver safety score
  - calculate insurance risk
  - signal potential unsafe situations
- Be GDPR compliant
  - Share minimum amount of data
  - Share anonymised data anonymously
  - Crystal clear algorithms

Vehicle

Private data

Non-private data

Safe local processing

Anonymous sharing

Trusted party

General Data Protection Regulation

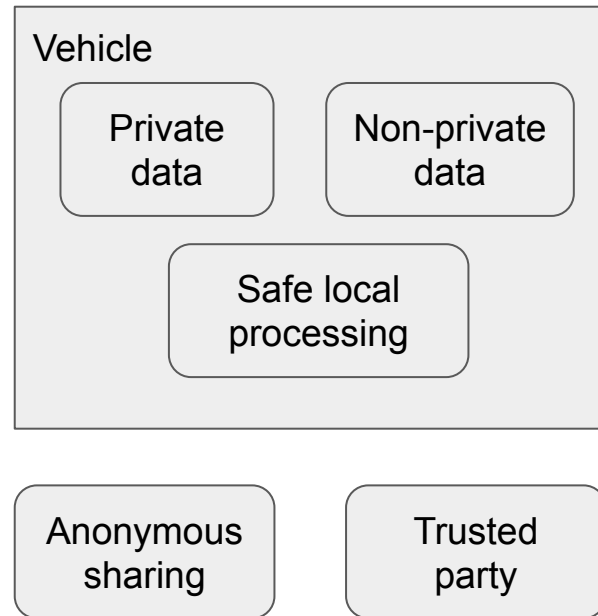Data ownership, privacy and mutual trust between parties are key

Smart mobility with multiple parties

- Parties
  - Driving schools
  - First responders
  - Roadside assistance
  - Insurance / lease company
  - Car Manufacturer
  - (Local) Government
- Equal playing field
  - Common infrastructure / architecture
  - Open interfaces / secured data exchange
  - All organisations have equal access
  - Vehicle driver chooses its partners
  - Open data whenever possible

Vehicle
- Private data
- Non-private data
- Safe local processing

Anonymous sharing

Trusted party

Data ownership, privacy and mutual trust between parties are key

The road to success

- Start small with limited scope
  - Driving Coach for young drivers
  - Feedback on driver behaviour
- Buildup experience
- Connect to European road safety and science programmes
- Find suitable development and business partners (NGO, GO, Commercial)
- Focus on developing an open ECO system
  - Open data sharing
  - Inclusive / not exclusive
  - Data ownership
  - Trust
  - Work on a common goal

What to do next, so many questions

- Questions for the audience:
  - Will these ideas help to reduce road accidents and make our life safer?
  - Are there any major issues that hinder this and need to be addressed in more detail.
  - Think what can you do?
- The next step:
  - Share these ideas within our organisation, mobility partners
  - Discuss, investigate and experiment to learn more
  - Look out for partners?

Millions of euro's are spend each year on Road Safety and scientific research programmes

The average car has safety belts and airbags but does not communicate its story

Let see if we can use innovation to make the road safe again!

Where to find more information

Dutch mobility innovations

https://dutchmobilityinnovations.com/spaces/86/dutch-mobility-innovations

Github project website: https://github.com/Tauvic/DriverAwareness

Wegenwacht

SWOV
WETENSCHAPPELIJK
ONDERZOEK VERKEERSVEILIGHEID

CBR Centraal Bureau Rijvaardigheidsbewijzen

VEILIGVERKEER

RB Vereniging Rijschool Belang

TASKFORCE VERKEERSVEILIGHEIDSDATA
1010010

Ministerie van Infrastructuur en Waterstaat

VNG Vereniging van Nederlandse Gemeenten

OPEN DATA

Verkeerskunde. VAKVISIE VAKKENNIS VAKMENS

STAR Smart Traffic Accident Reporting

VERBOND VAN VERZEKERAARS

BOVAG

kennis netwerk spv Strategisch Plan Verkeersveiligheid

Sensors
- Camera
  - Infrared
- Acceleration
- Velocity
- GPS location
- Indicator lights

Features
- Driver recognition
- Head pose
- Gaze direction
- Eyes closed / blink
- Hand position
- Distraction

Algorithm
- Machine learning
- State machine
- Rules & parameters

Driver state
- Alert
- Distracted
- Drowsy

System services
- Display
- Buzzer
- Processor
- Memory
- Storage
- Network

System diagram

Might have

Must have