

Driver Monitoring System for Enhancing Road Safety

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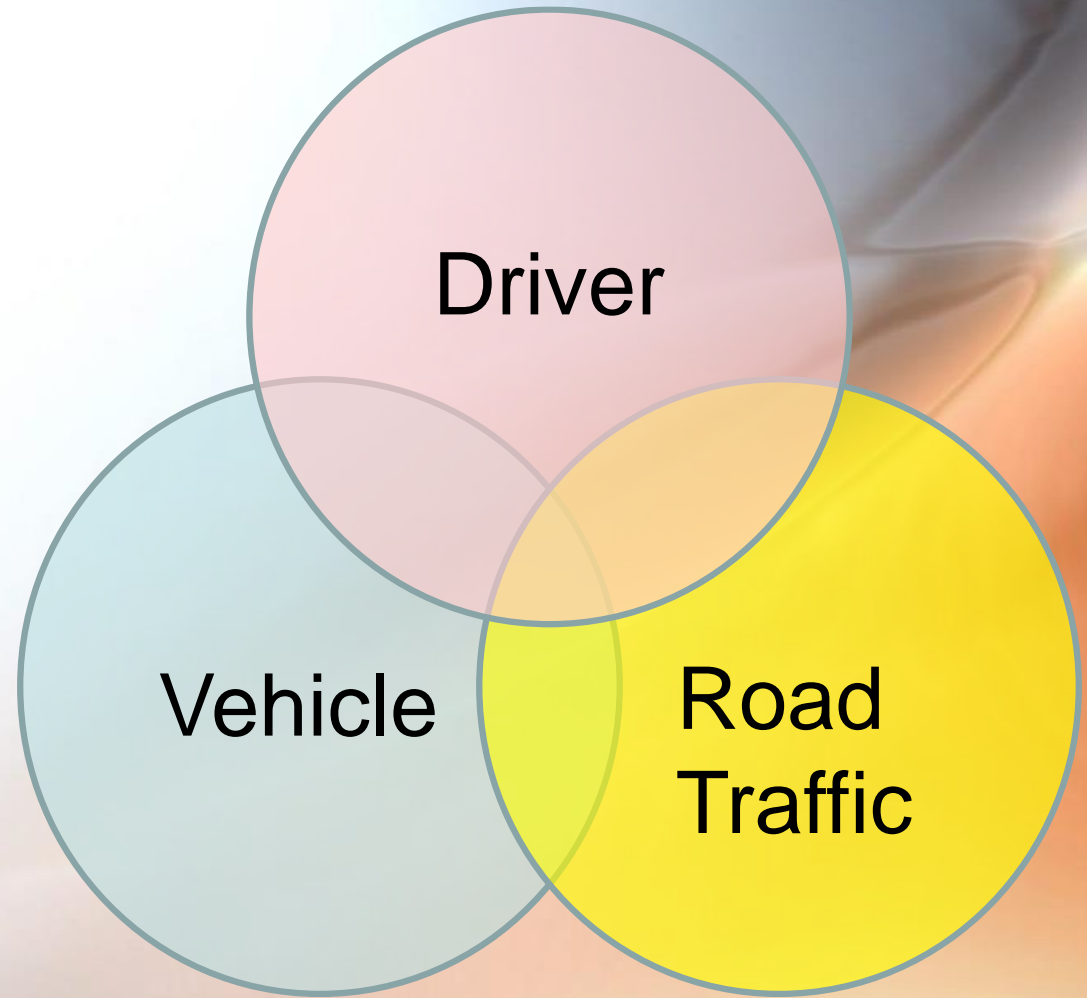
smartmobility.cu@gmail.com
www.smartmobility.eng.chula.ac.th



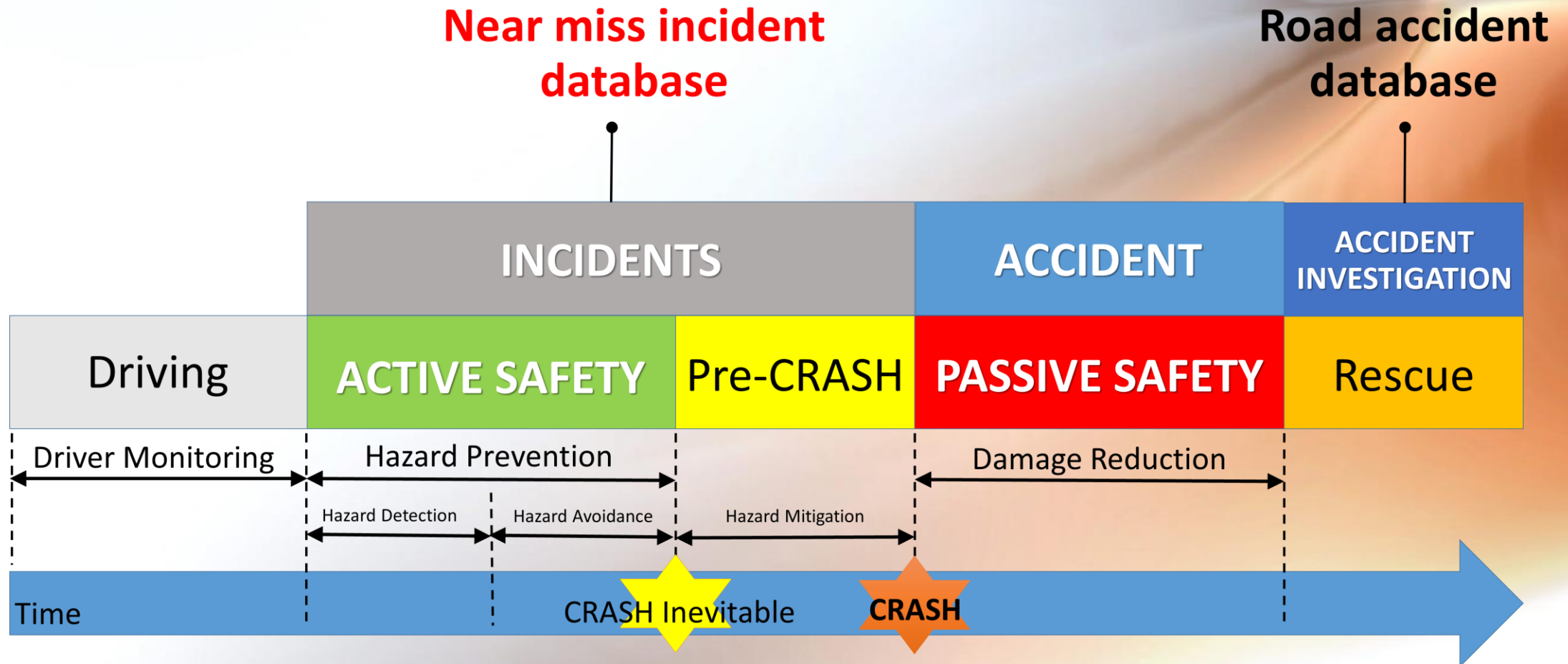
R&D

Concept of Road Safety

NEAR MISS INCIDENT
DATABASE FOR
IMPROVING CAR
SAFETY

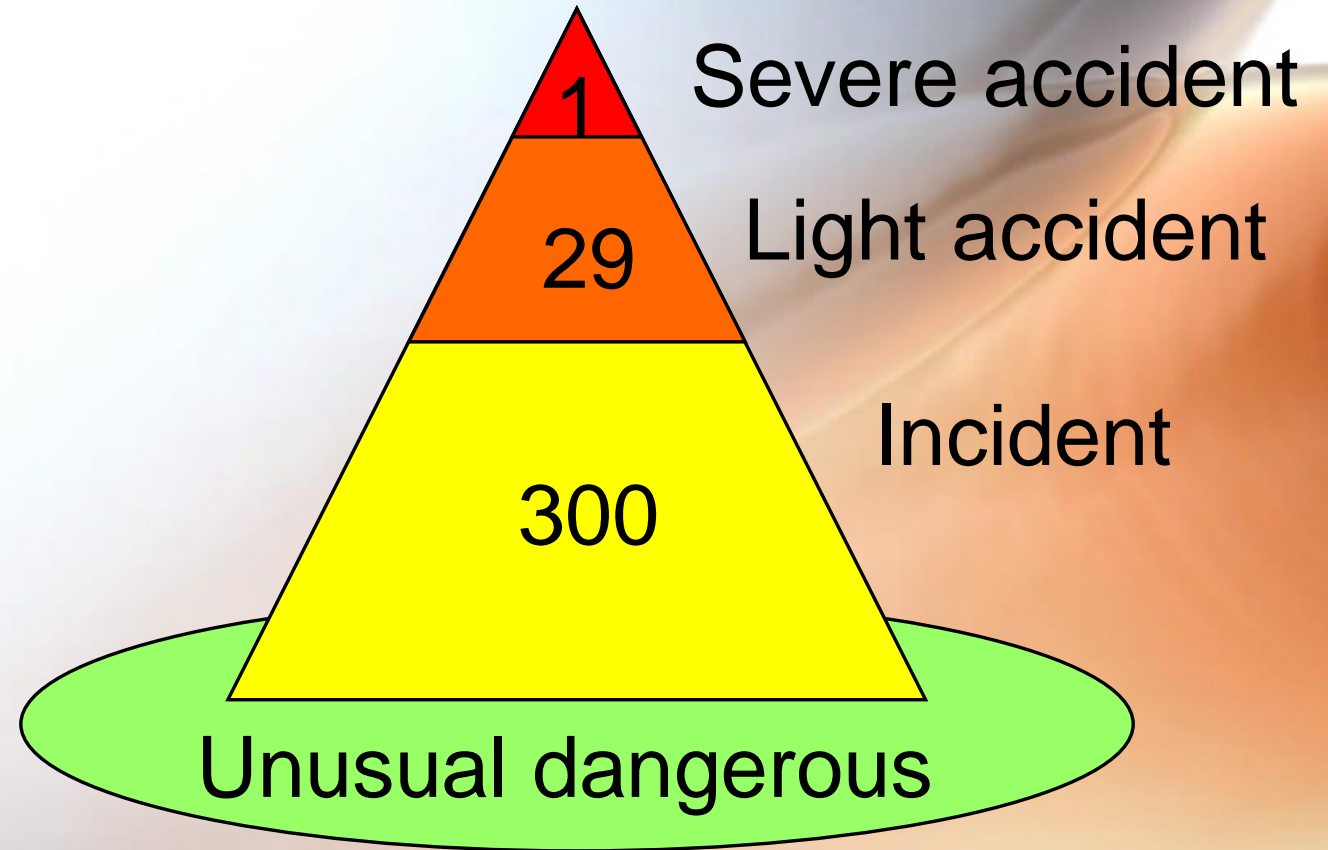


NEAR MISS INCIDENT DATABASE FOR IMPROVING CAR SAFETY

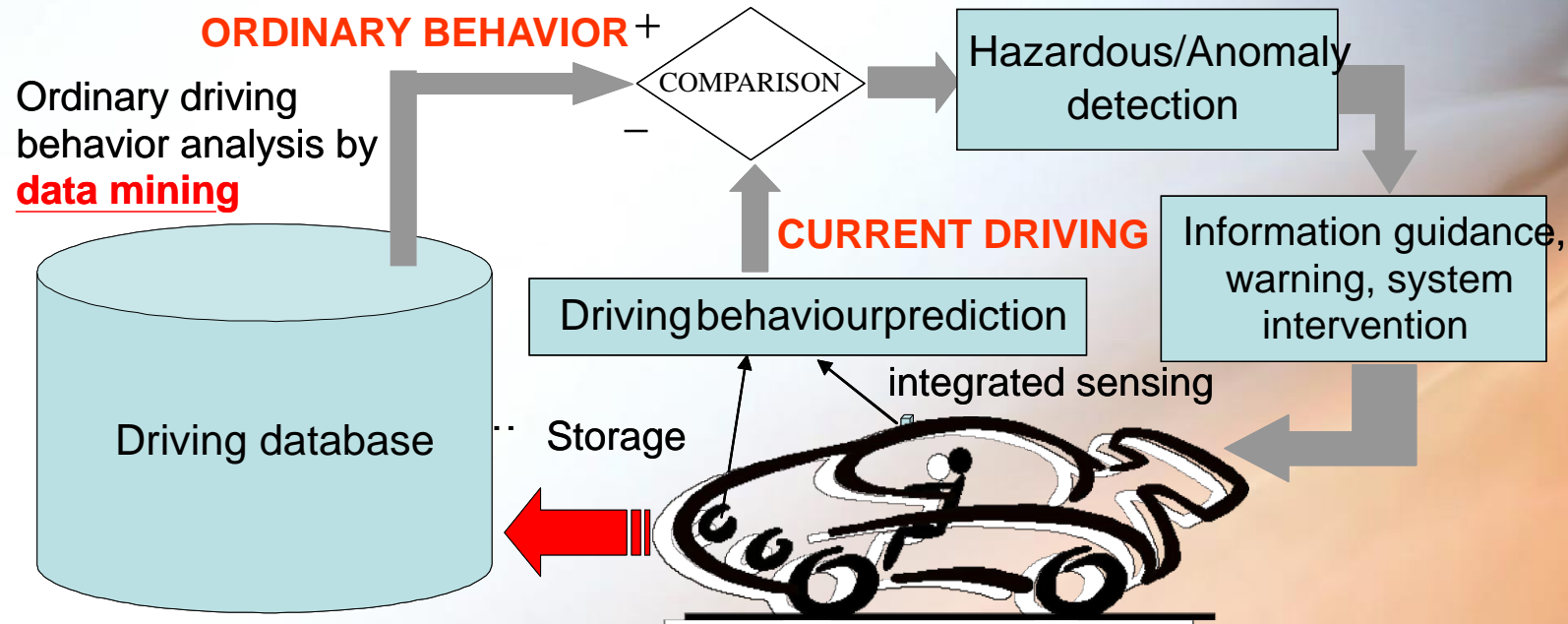


NEAR MISS INCIDENT
DATABASE FOR
IMPROVING CAR
SAFETY

Heinrich's law, labor accident



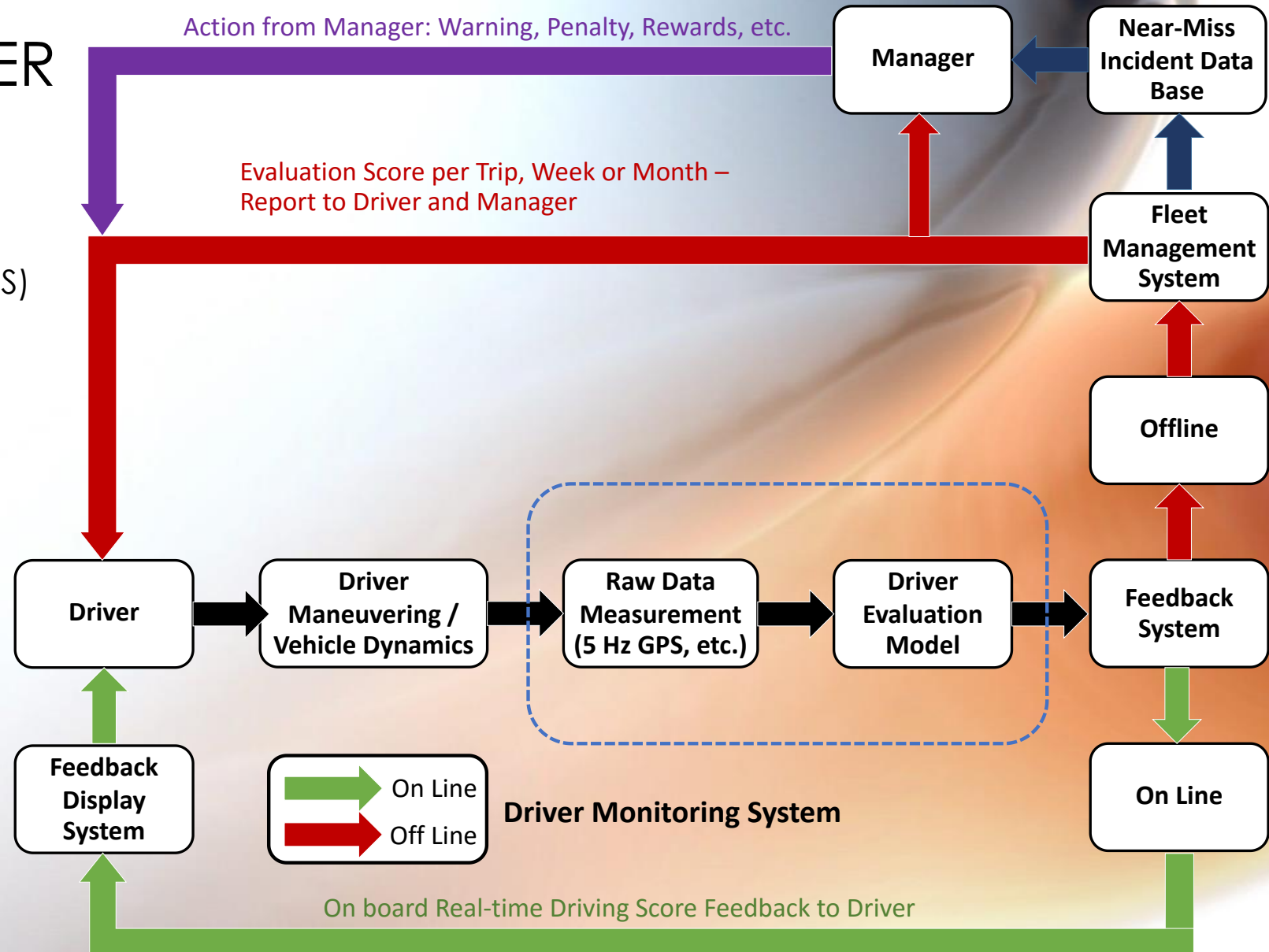
MOBILITY SENSING FOR SAFETY AND SECURITY



Based on the storage driving database in naturalistic driving :
Feature extraction of naturalistic driving behavior/pattern
Driving state degradation detection
Adaptive HMI design of driver assistance (ACC, LKAS, FCWS, LDWS)

CONCEPT OF DRIVER MONITORING SYSTEM

based on RISK DRIVING SCORE (RDS)



Probe Developments

Multi-GNSS

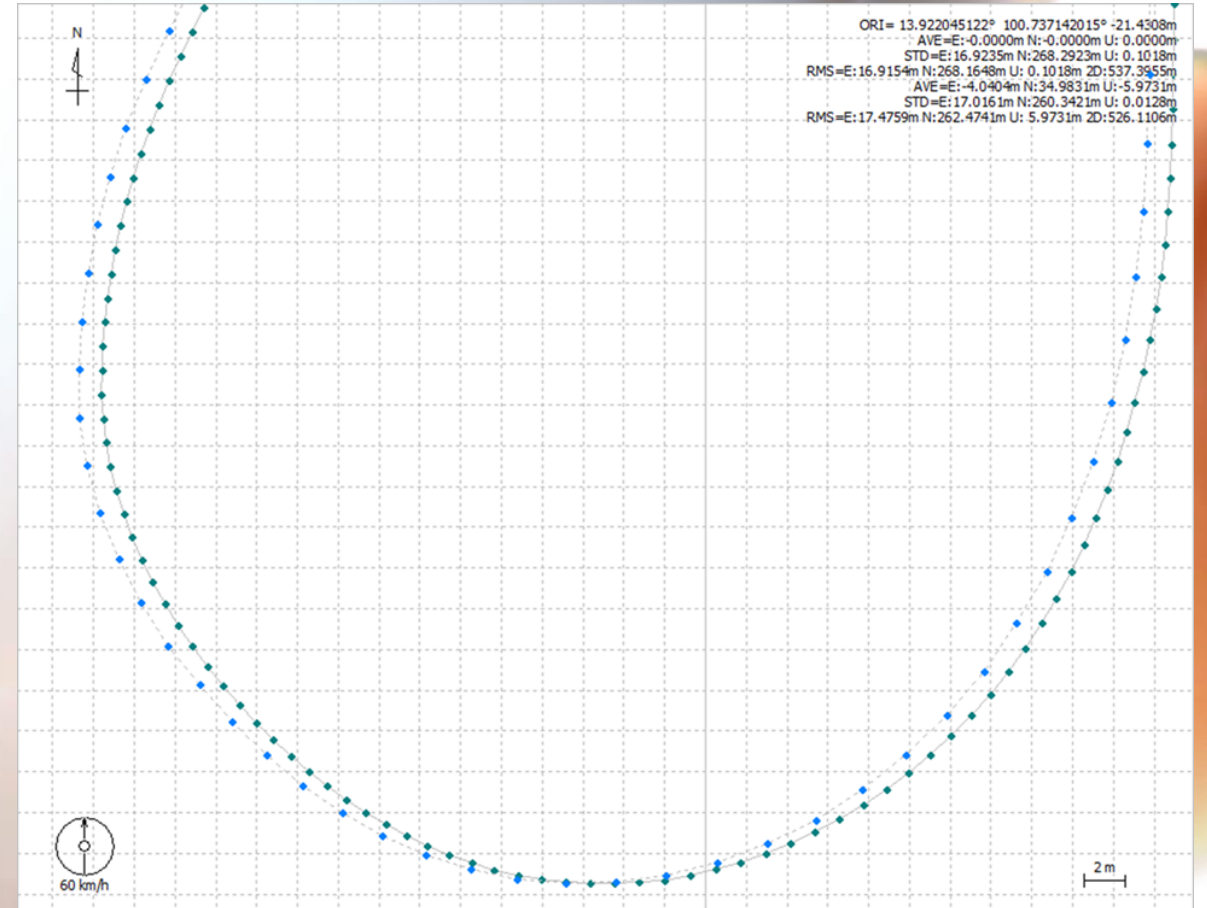


Availability of u-blox[®] high resolution receivers

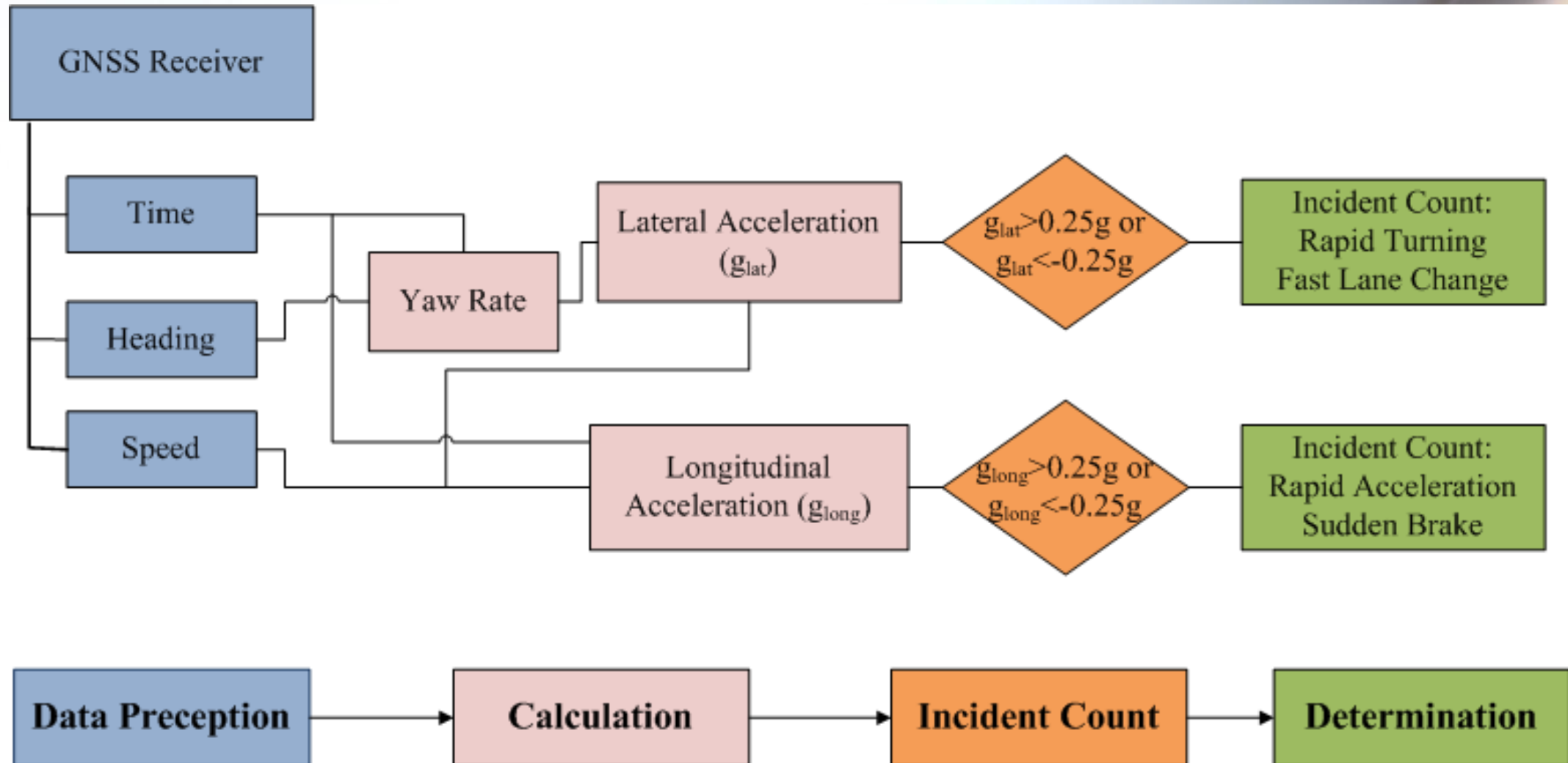
2014

U-blox

- 5-Hz resolution
- meter trajectory accuracy



Detection Methodology



DLT Lamlukka test track

Track





Selected Test Clip

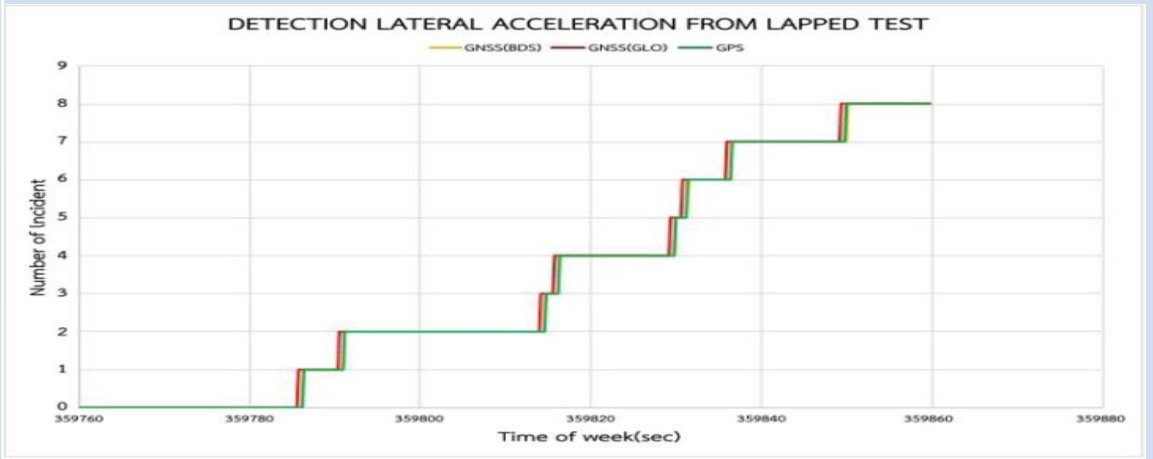
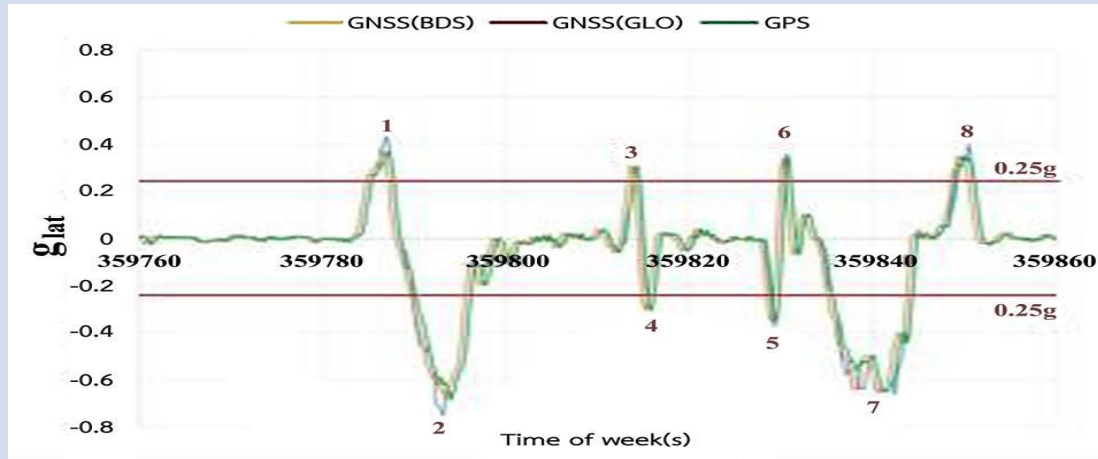


Selected Test Clip

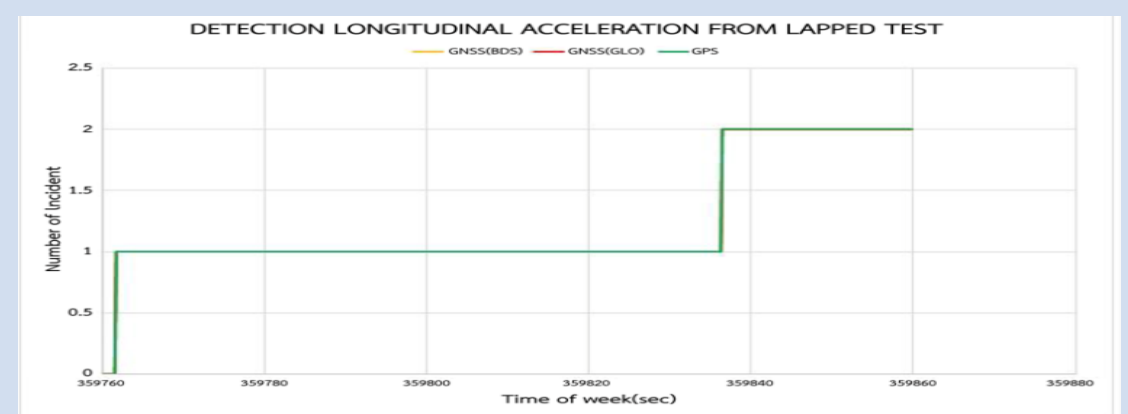
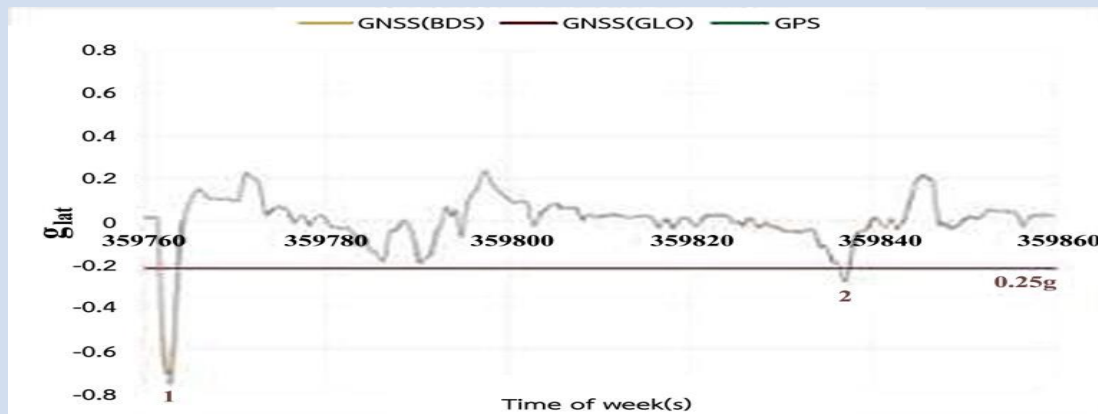


Results

Detection of excessive lateral acceleration



Detection of excessive longitudinal acceleration



Development of Driver Evaluation Model

Risk Driver Score (RDS)

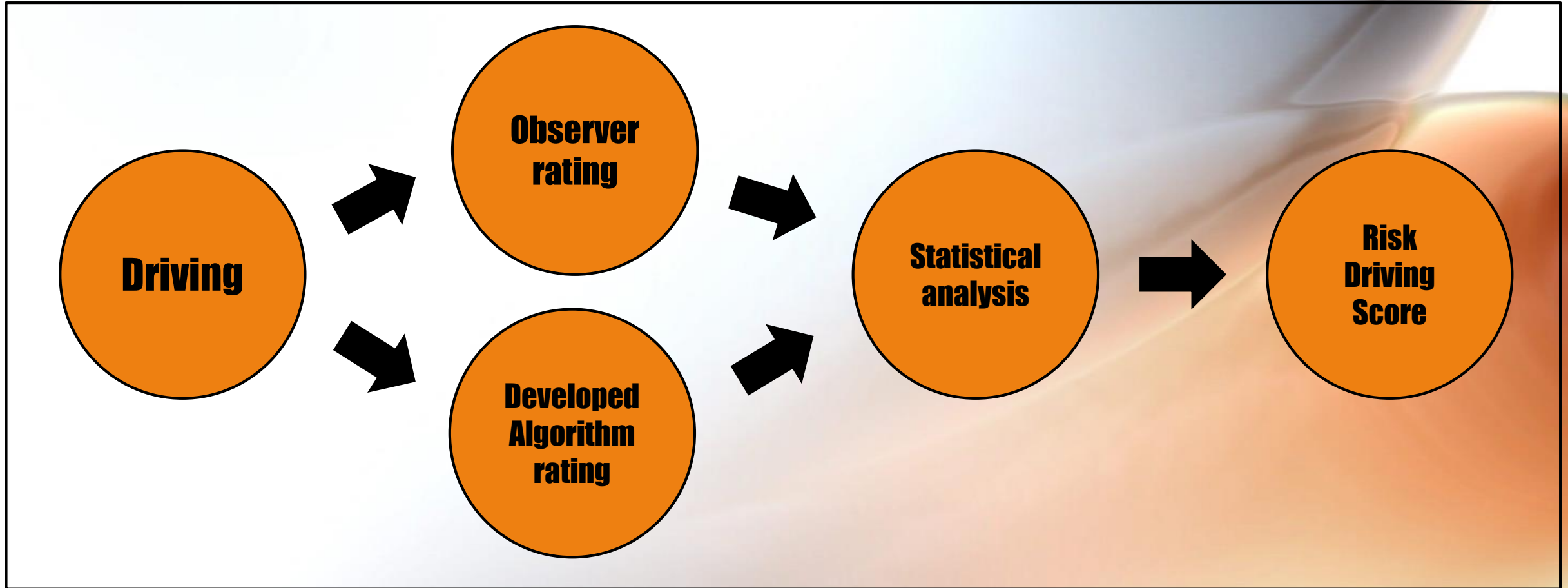
How to Evaluate Driving

- Evaluation by the risk
- Risk is a chance of road accident while driving
- Normally, High velocity and high acceleration can lead to the road accident so that risk was defined by velocity and acceleration compare with driving distance

- Risk driving score (RDS) =
$$\frac{\frac{1}{f} \sum v_i \times a_i}{distance}$$

Both Velocity and Acceleration should be two of factor that affect risk of driving

Methodology



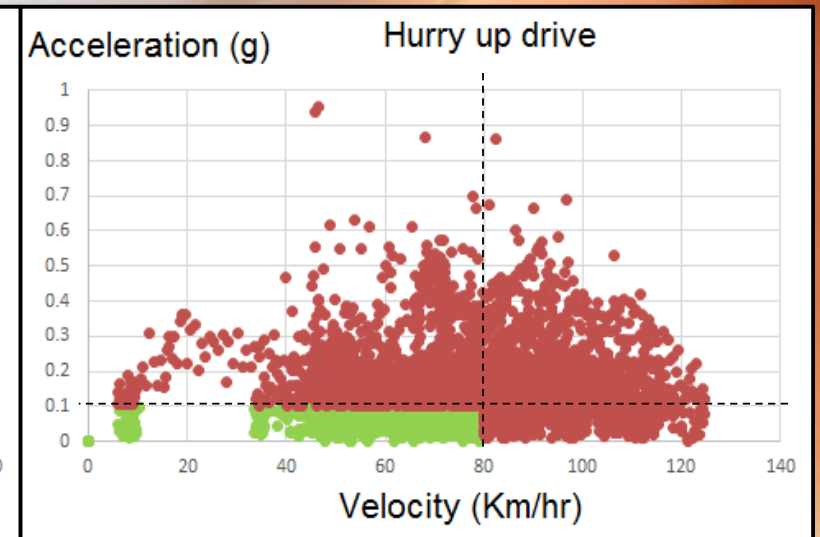
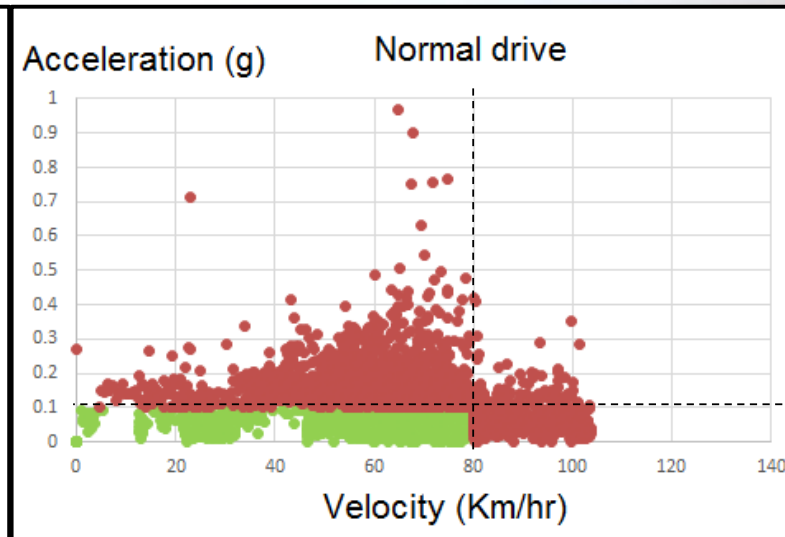
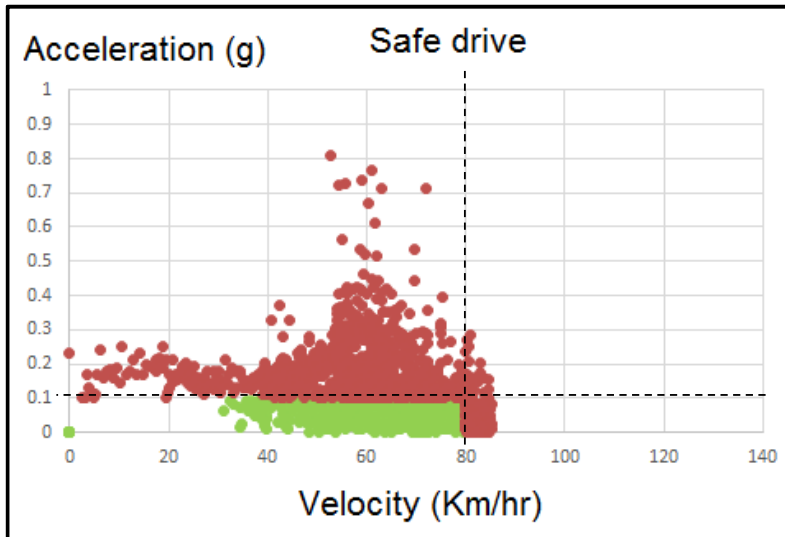
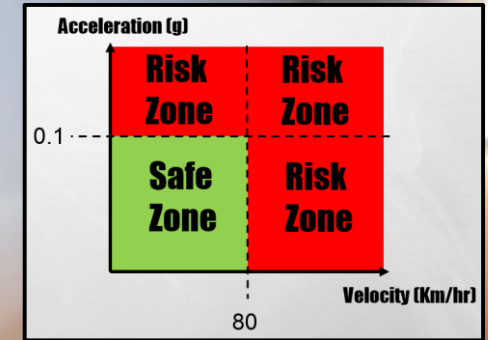
Driving expert	Driving simulator	Observer	Data recorder	Developed algorithm	Passenger	Self-reported questionnaire	Occupational therapist	Researcher	Correlation $r = ?$
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Fine Tune Driver Evaluating Algorithm for different traffic conditions



Well trained driving instructors from SCG Skills Development Practice Learning Center

DATA COMPARING

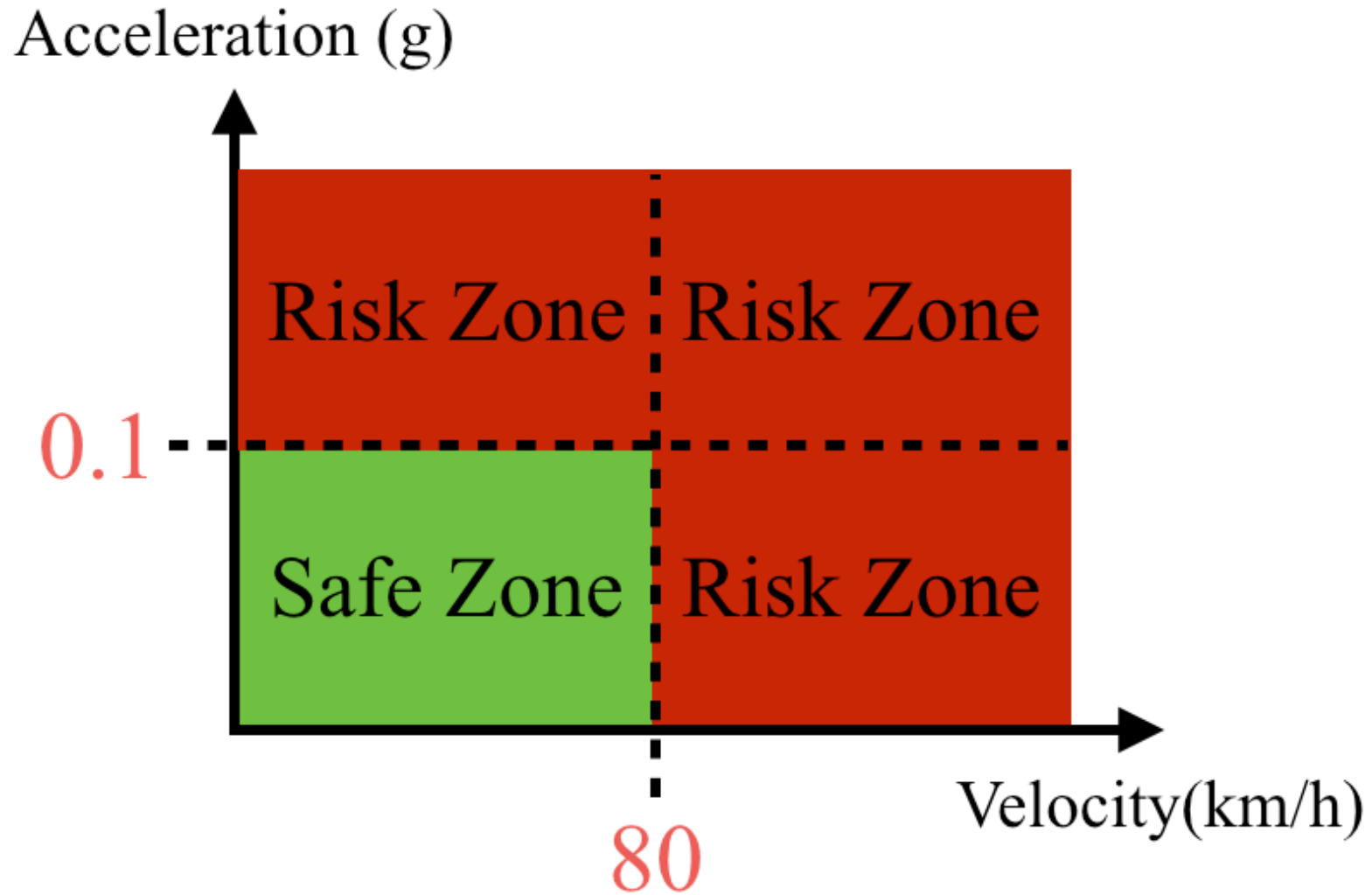


Condition	Observer score	Algorithm score
Safety drive	1.00	1.37

Condition	Observer score	Algorithm score
Normal drive	2.00	2.08

Condition	Observer score	Algorithm score
Hurry up drive	4.85	4.54

Safe Zone



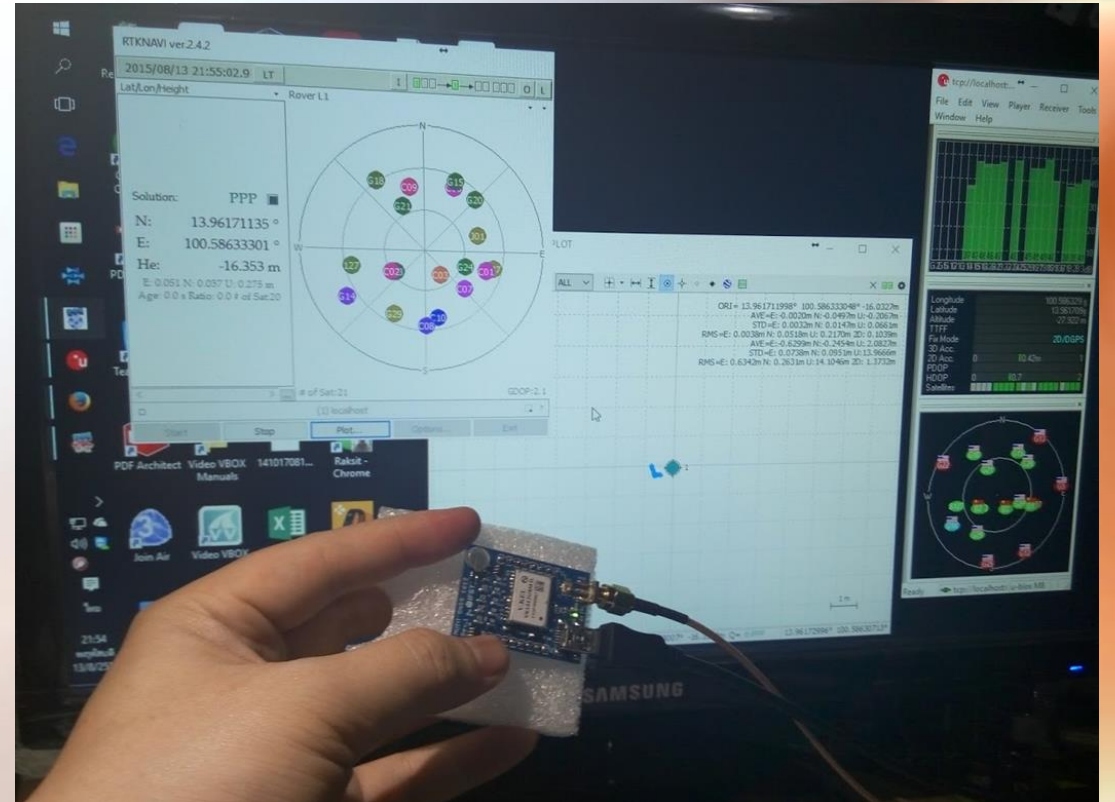
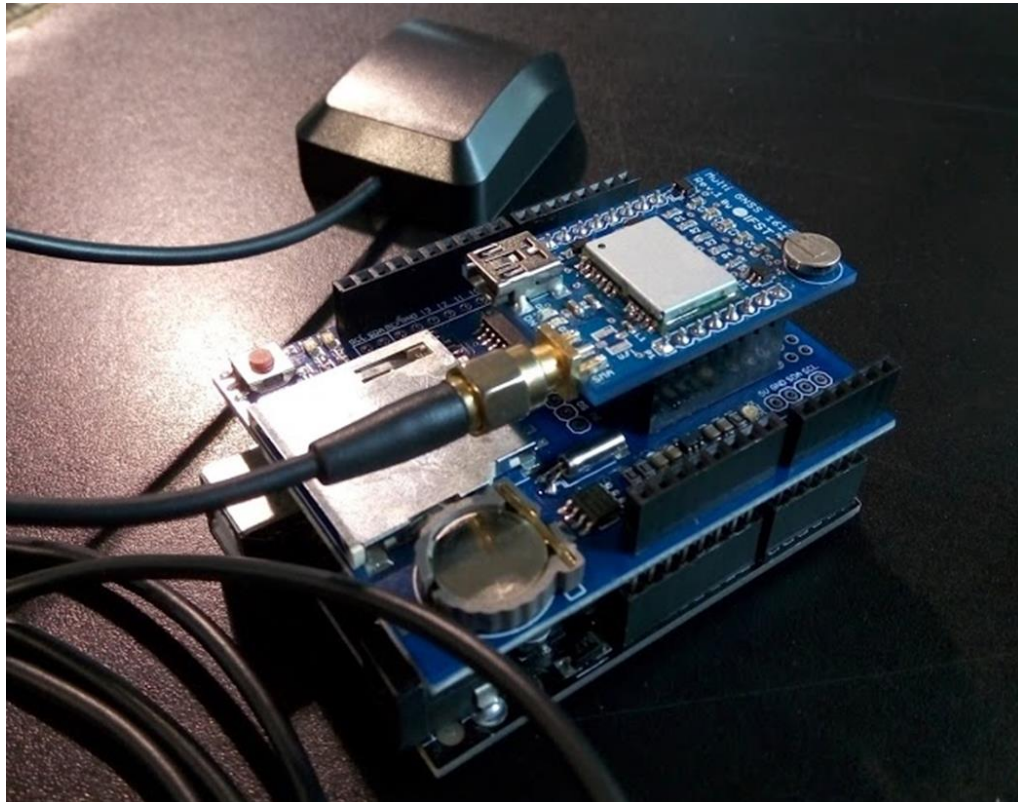
Commercialization

Infinite Sora Technology, Co., Ltd.
www.infinitesora.com



Product Pictures

Multi-GNSS receiver



Agenda



Data Capture

Data Analysis

Incident @ 0.25G

Incident @ 0.3G

Data Capture



Data Capture w Multi-GNSS Receivers

Ublox M8030 Multi-GNSS

(GPS+BDS+QZSS)

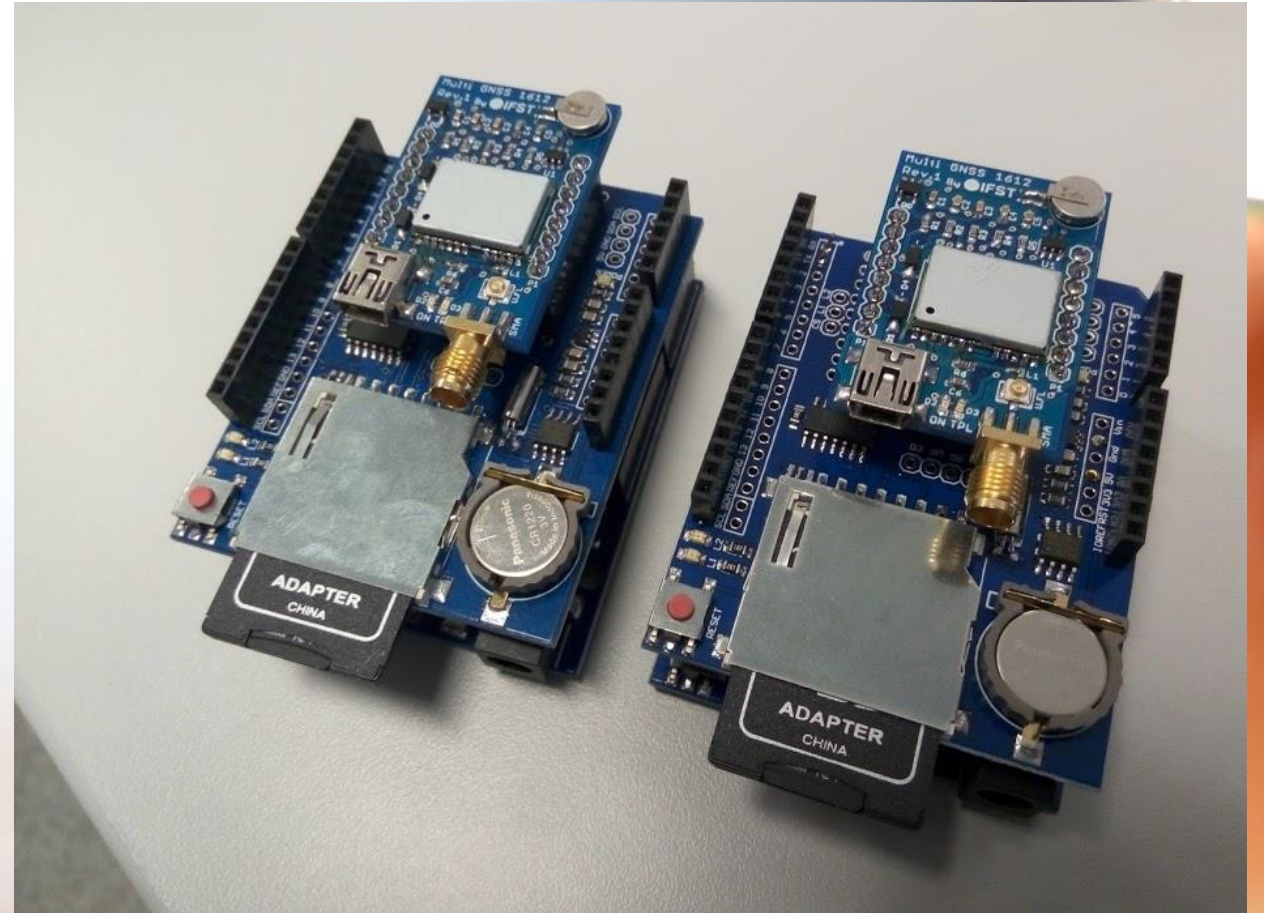
(GPS+GLO+QZSS)

Setting for Automotive filter output

Raw satellite measurement

High Frequency Datalogger

5-Hz update rate (positioning and
raw)



Infinite Sora Technology

Make Things Run Internet

Data Analysis

- Based on technical paper
- Thitipatanapong, R., Chantranuwathana, S., Noomwongs, N., Boonporm, P. et al., "Vehicle Safety Monitoring System with Next Generation Satellite Navigation: Part 2 Excessive Acceleration Detection," SAE Technical Paper 2015-01-0124, 2015, doi:10.4271/2015-01-0124.
- <http://papers.sae.org/2015-01-0124/>
- The Multi-GNSS probe is process for longitudinal acceleration and lateral acceleration.
- Both acceleration are applied as indicator for incident and dangerous event.
 - Above 0.25g as regress incident
 - Above 0.30g as dangerous incident



Above 0.25g – regress driving

Date(Sep)	15	16	17	18	19	
Distance	167	171	199	228	246	km.
Hard Brake	28	20	10	52	41	events
Aggressive Turn	9	7	1	4	1	events
Rating	252	158	60	277	187	Events per 1000 km

Above 0.25g – regress driving

- 5 operational day with distance 1,010 km
- Acquired for 173 incidents
- 171 incidents / 1000 km
- Recommend not above 10 incidents / 1000 km



Above 0.30g - dangerous driving

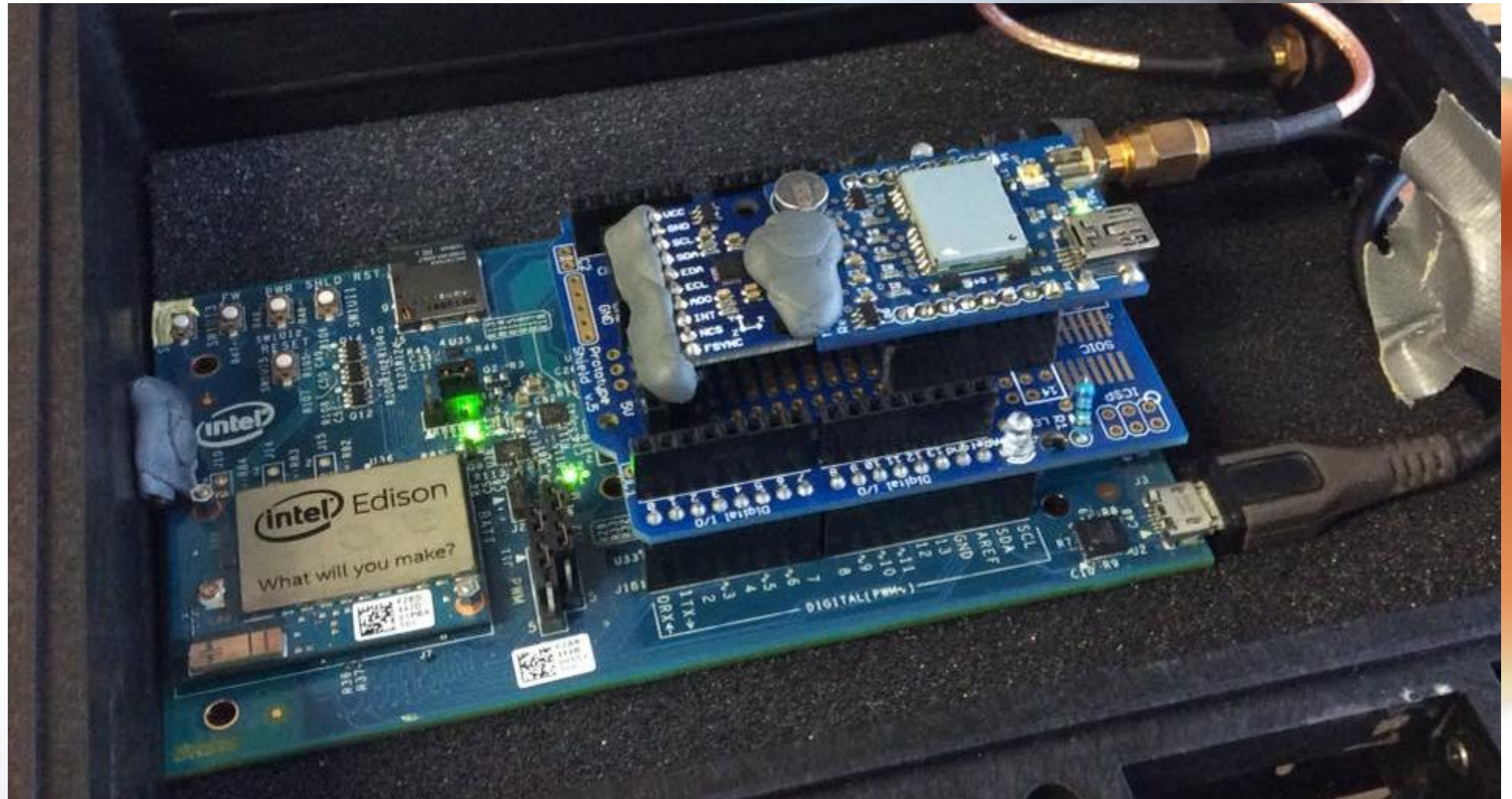
Date(Sep)	15	16	17	18	19	
Distance	167	171	199	228	246	km
Hard Brake	5	0	1	7	4	incidents

Above 0.30g - dangerous driving

- 5 operational day with distance 1,010 km
- Acquired for 17 incidents
- 17 incidents / 1000 km
- Recommend not to happen



Integrated On-line Monitoring System



Supporter



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