SMART MOBILITY RESEARCH CENTER
FACULTY OF ENGINEERING, CHULALONGKORN UNIVERSITY

IFST
Make things run Internet

AUTOMOTIVE SUMMIT 2015

VEHICLE INCIDENTS DETECTION SYSTEM BY MULTI-GNSS

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2010

INSPIRATION

IN 2013, THAILAND IS 3RD RANK ROAD ACCIDENT FATALITIES BY WHO.

- Accidents cause from
  - Man
  - Road
  - Vehicle
- The most important parts is driver.

IN-VEHICLE DATA-LOGGER

Tachometer
Inertia Measurement Unit
GPS/GNSS

Conventional GPS cannot use
10-Hz Navi system

2011

ENDORSEMENTS

JAVAD MULTI-GNSS MODULE

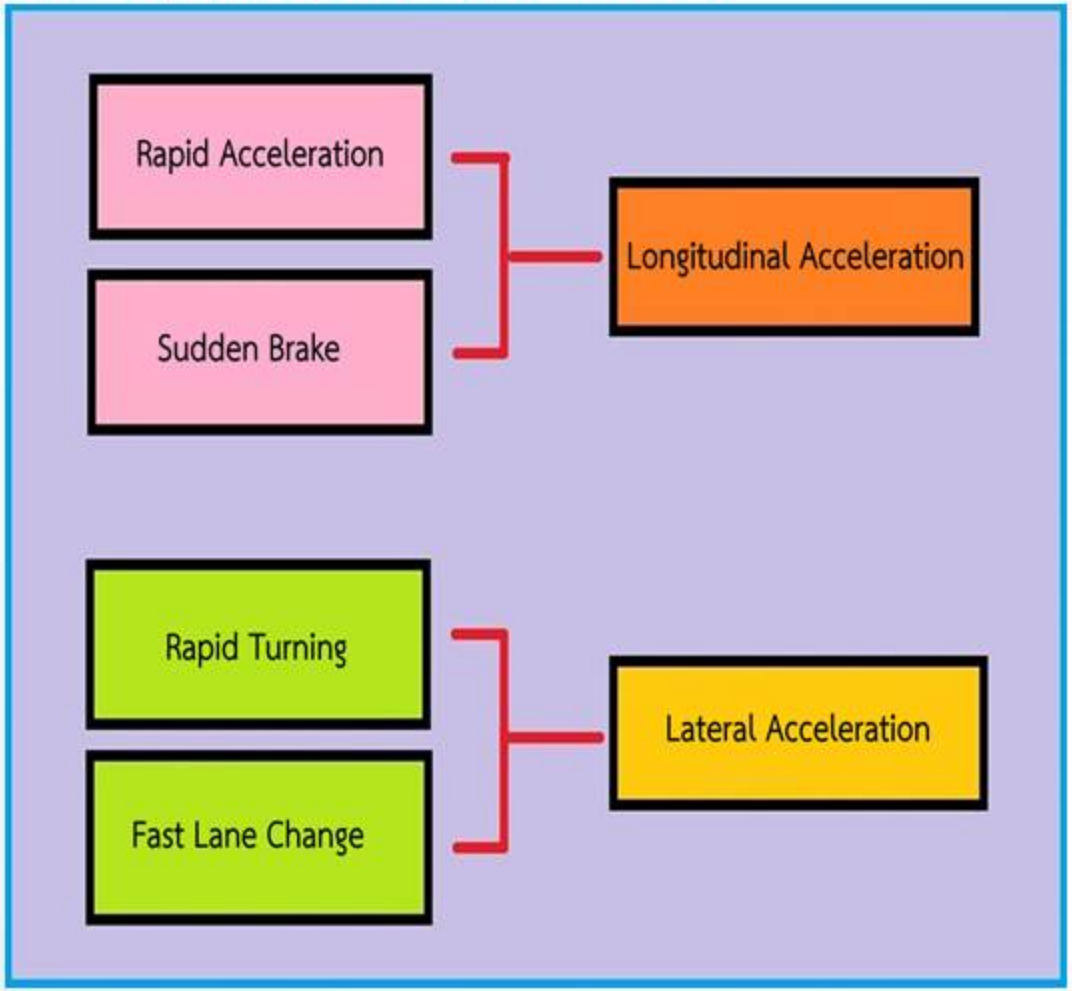
Centimeter accuracy
High resolutions

2012

EXPERIMENTAL DRIVER BEHAVIORAL ANALYSIS FROM NAVIGATION SYSTEM

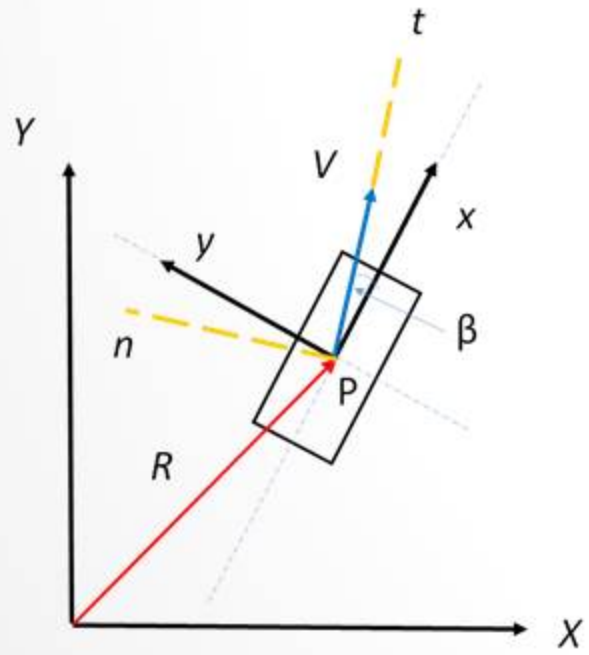
INTRODUCTION & MOTIVATION

- Road accidents
- Dangerous Driving Behavior



การประเมินความเร่งเข้าสู่ศูนย์กลางด้วยระบบดาวเทียมนำร่อง

Kinetic Model of Vehicle:
An approximation data from Navigation System



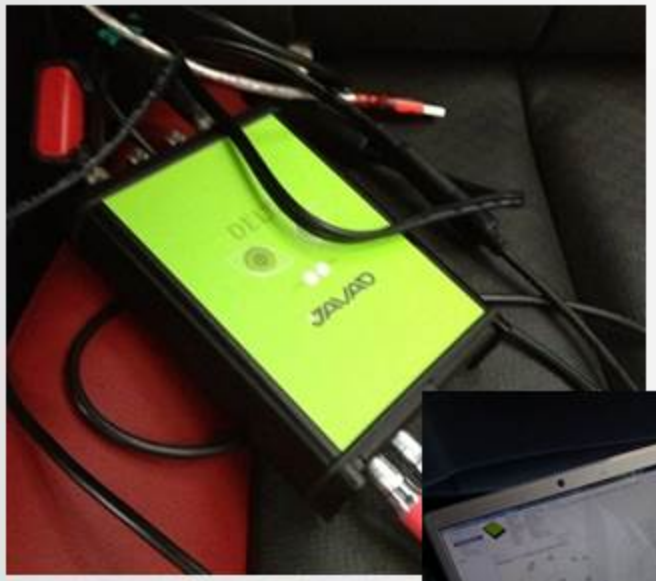
$$\ddot{R} = (\dot{u} - v\gamma)\hat{\imath} + (\dot{v} + u\gamma)\hat{\jmath} \quad (1)$$

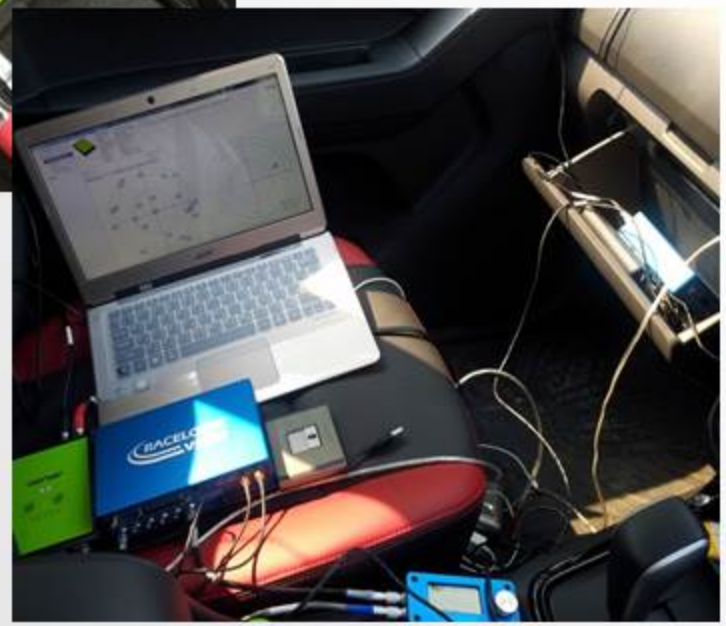
$$u = V\cos\beta \approx V \qquad v = V\sin\beta \approx V\beta \quad (2)$$

$$\ddot{R} = -V(\dot{\beta} + \gamma)\beta\hat{\imath} + V(\dot{\beta} + \gamma)\hat{\jmath} \quad (3)$$

$$a_{y,GNSS} = V\gamma \quad (4)$$

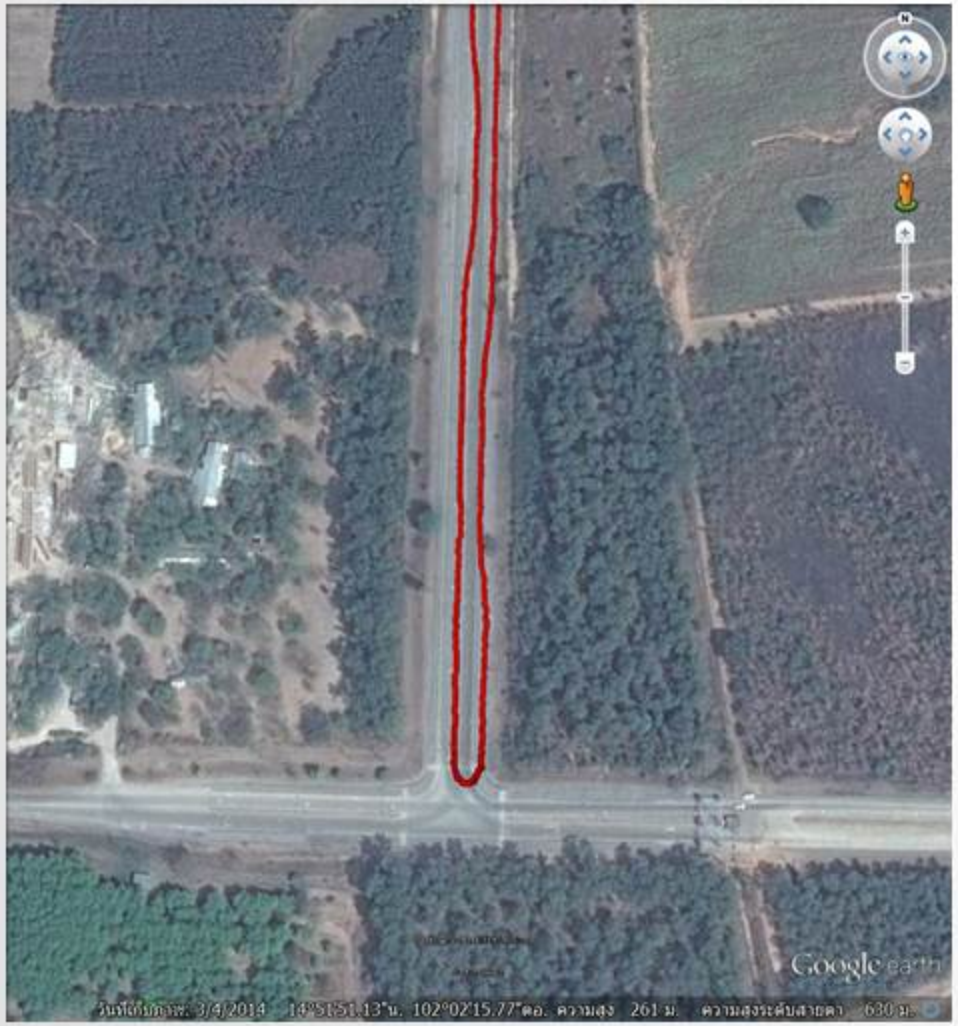
2012 TEST EQUIPMENT





ก. ข้อมูลจาก GNSS ปัจจุบัน

ข. ข้อมูลจาก GNSS 1 วินาที



ค. ข้อมูลจาก GNSS 100 มิลลิวินาที

ง. ข้อมูลจาก PPP GNSS

TEST RESULTS

- The precision from Multi-GNSS is the key to detect the risk incident in vehicle driver's behavior.
  - Single solution was enough for turning analysis.
  - RTK solution was required for lane changing analysis.
- Accuracy from RTK solution was less than actual lateral motion from lane changing.
  - Sub-meter class with high update rate capable for it.
  - PPP was considered

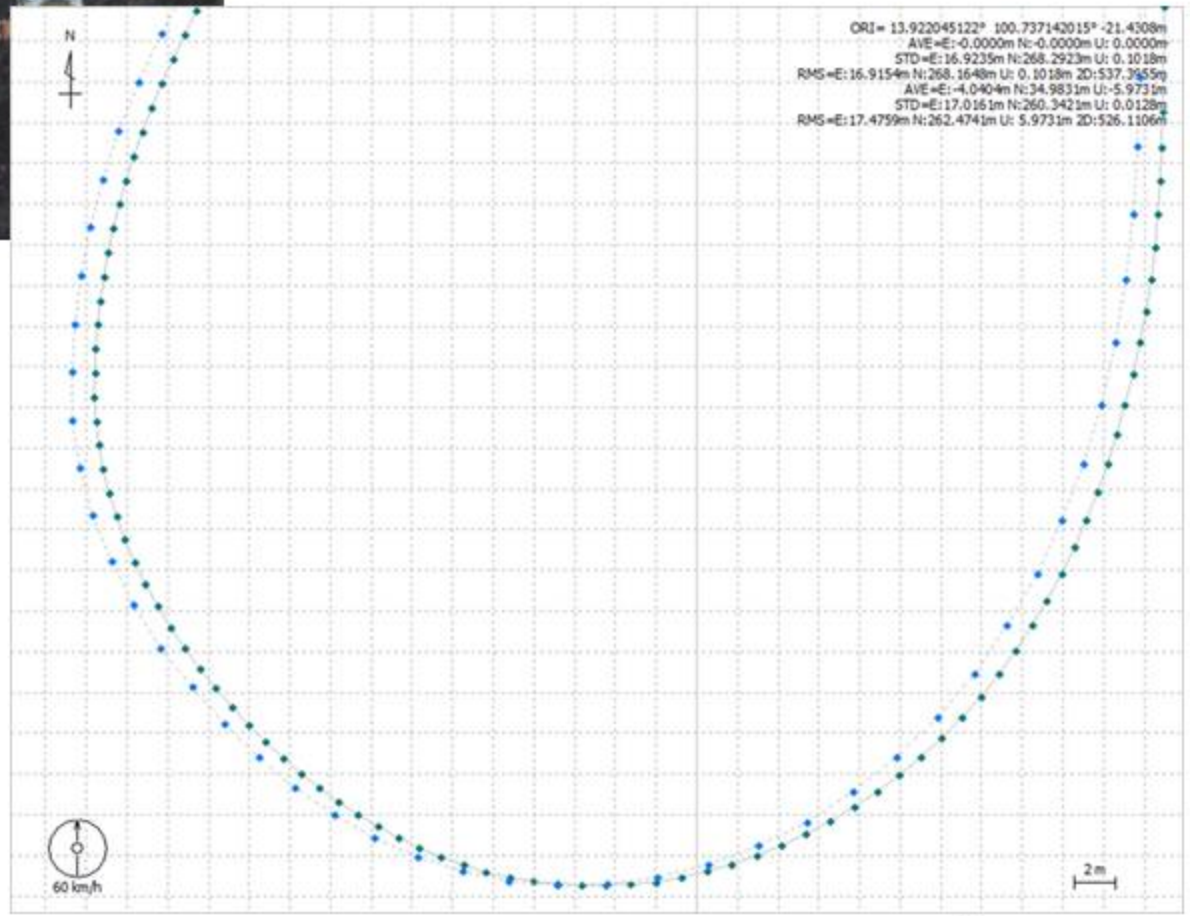
R. THITIPATANAPONG, S. KLONGNAIVAI, N. NOOMWONGS and S. CHATRANUWATHANA, "Study of Driver Behavior Detection on Vehicle with Satellite Navigation System (in Thai)," in GEOINFOTECH, GISTDA, Nonthaburi, Thailand, 2013.

2014

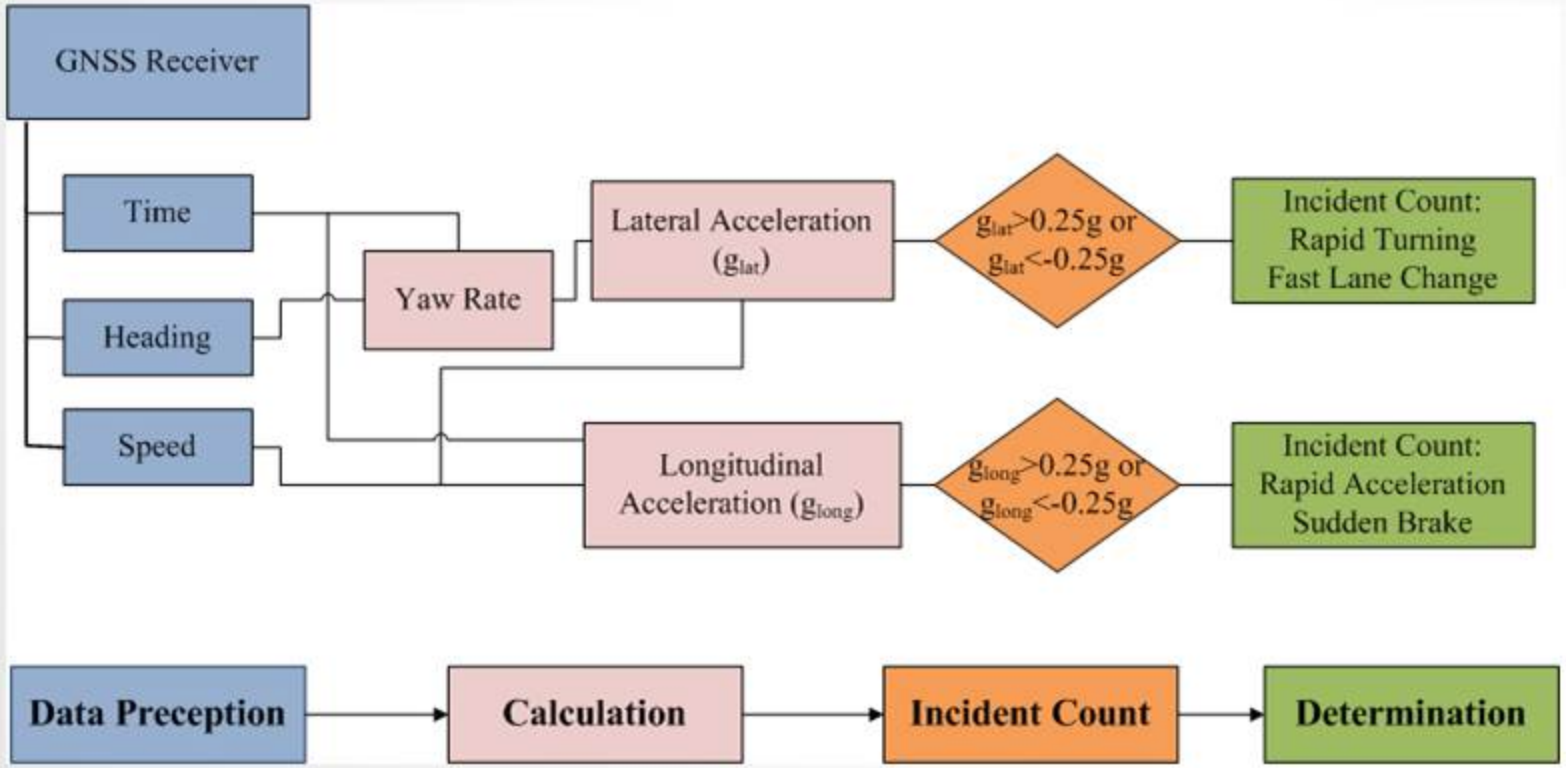
EXISTING OF U-BLOX® HIGH RESOLUTION RECEIVERS

U-BLOX

- 5-Hz resolution
- meter trajectory accuracy

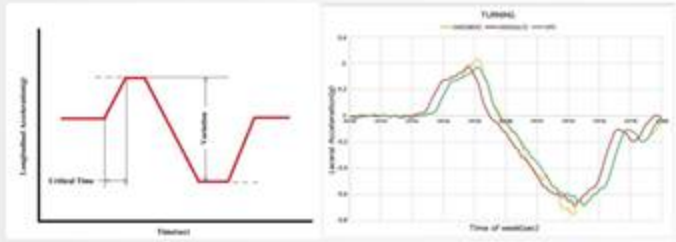


DETECTION METHODOLOGY

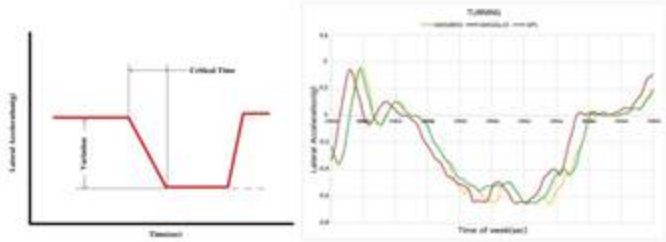


PATTERN ANALYSIS

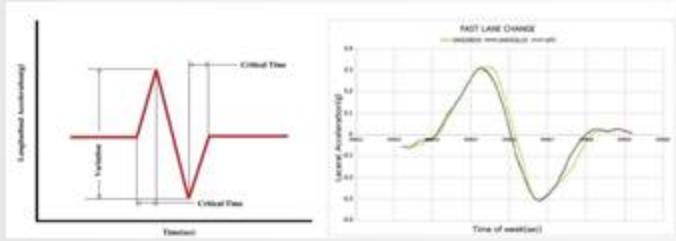
Rapid turning with double curvature



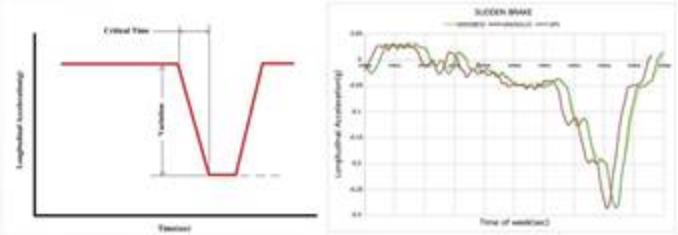
Rapid turning with single curvature



Fast lane change



Braking



Test Track

70 metres
Rapid Acceleration
Sudden Brake
FAST LANE CHANGE2
Rapid Acceleration
FAST LANE CHANGE1
Rapid Acceleration
START AND FINISH
TURNING 1
TURNING 2
850 metres

VDO1

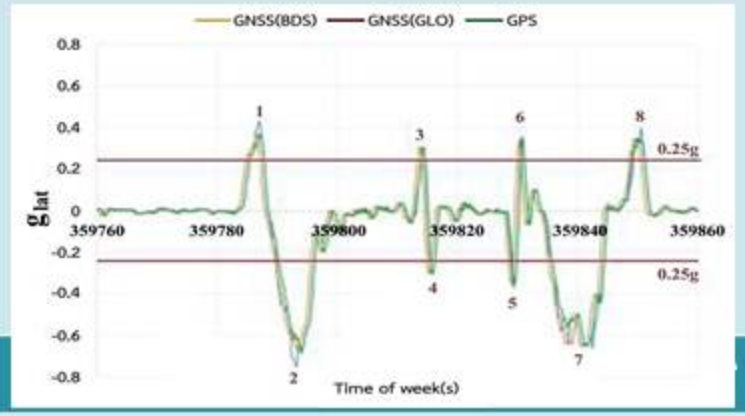
SELECTED TEST CLIP

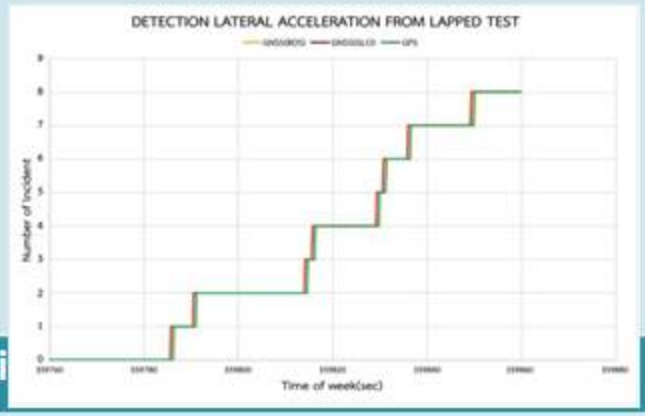
VDO2

SELECTED TEST CLIP

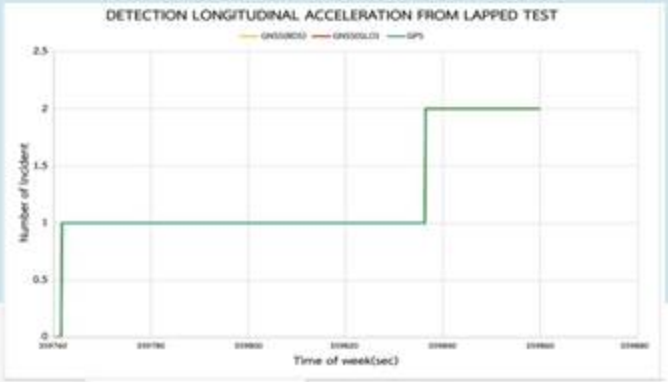
RESULTS AND DISCUSSION

Detection of excessive lateral acceleration





longi



2015

AUTOMOTIVE SUMMIT 2015

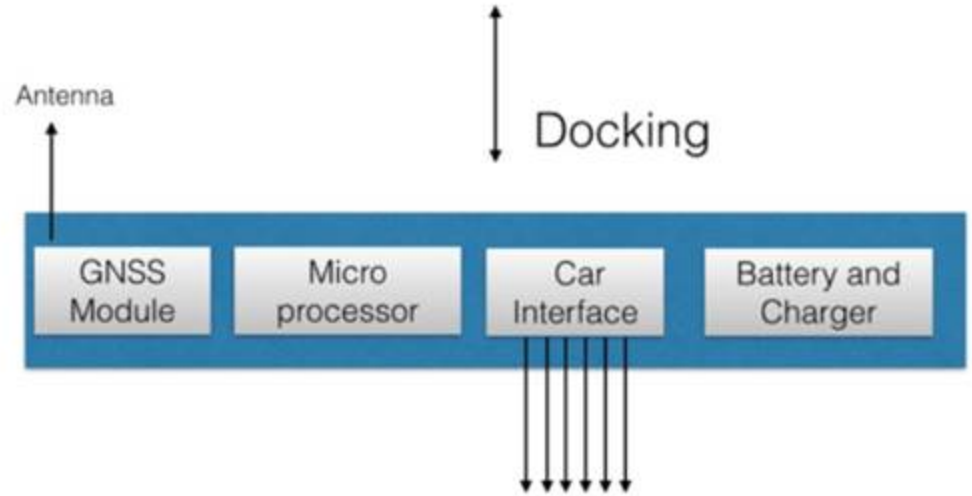
PRODUCT DEVELOPMENTS BUSINESS START-UP

IFST

Make things run

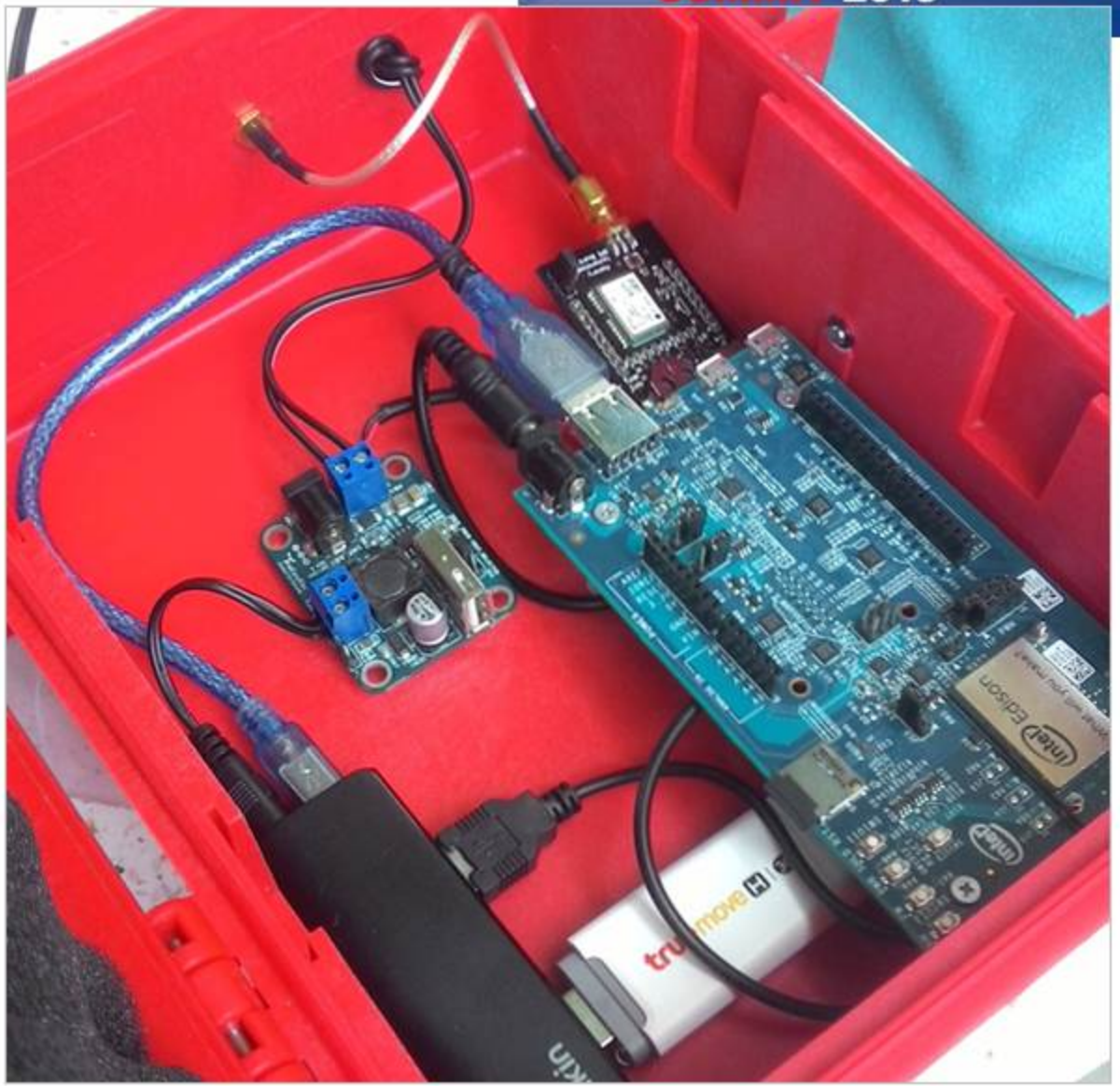
IN-VEHICLE SYSTEM

- Big-Data, from 1 point per minute to 5 points per second, 300 times!
- 3G & 4G infrastructure enable this applications

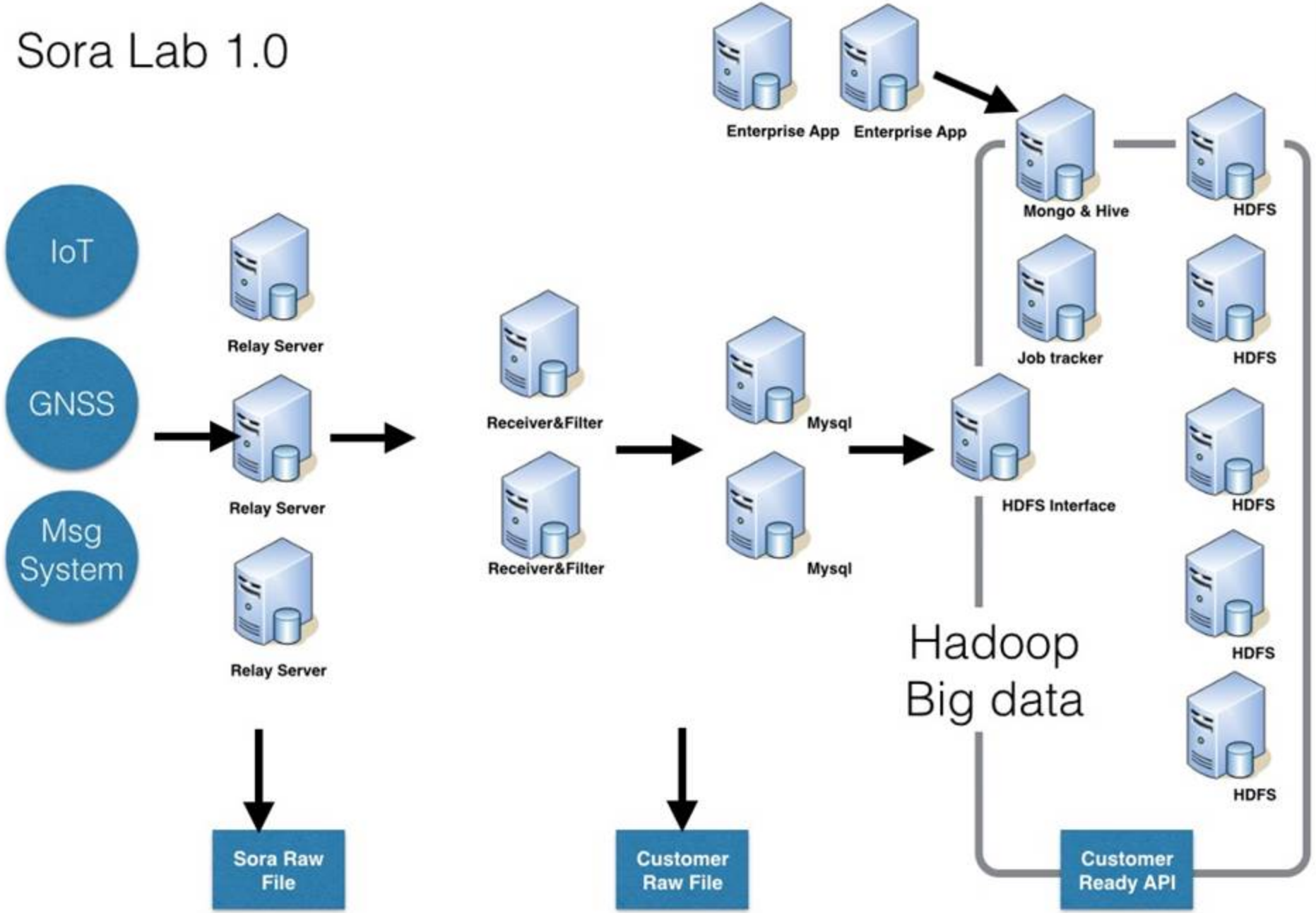


OBD-II [Car Interface]
DVB-T2/S [Digital TV]
SORA Content Server

IN-VEHICLE SYSTEM



Sora Lab 1.0


Enterprise App
Enterprise App
Mongo & Hive
HDFS
IoT
GNSS
Msg System
Relay Server
Relay Server
Relay Server
Job tracker
HDFS
HDFS
Receiver&Filter
Receiver&Filter
Mysql
Mysql
HDFS Interface
HDFS
HDFS
HDFS
Hadoop
Big data
Sora Raw File
Customer Raw File
Customer Ready API

REPORT SYSTEM

- Alert: Critical Situation
- Risk Behaviors: Within limits
- Eco Drive: Suggests
- Analysis: Improvements

BUSINESS PARTNERS

intel

FURUNO

ComNav