



# SAFERIDER



## ADVANCED TELEMATICS FOR ENHANCING THE SAFETY AND COMFORT OF MOTORCYCLE RIDERS

FP7-ICT1-216355



### PROJECT PRESENTATION

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<sup>1</sup> PU: Public; RE: Restricted; CO: Confidential

<sup>2</sup> F: Final; D: Draft; RD: Revised Draft

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## List of Abbreviations

ACEM	ASSOCIATION DES CONSTRUCTEURS EUROPÉENS DE MOTOCYCLES (ASSOCIATION OF EUROPEAN MOTORCYCLE INDUSTRY)
ADAS	ADVANCED DRIVER ASSISTANCE SYSTEMS
eCall	EMERGENCY CALL
FEMA	FEDERATION OF EUROPEAN MOTORCYCLISTS' ASSOCIATION
FERSI	FORUM OF EUROPEAN ROAD SAFETY RESEARCH INSTITUTES
FIM	FEDERATION INTERNATIONALE DE MOTOCYCLISME (INTERNATIONAL FEDERATION OF MOTORCYCLISTS)
FMEA	FAILURE MODES & EFFECTS ANALYSIS
HMI	HUMAN-MACHINE INTERACTION
ICT	INFORMATION AND COMMUNICATIONS TECHNOLOGIES
IST	INFORMATION SOCIETY TECHNOLOGIES
ITS	INTELLIGENT TRANSPORTATION SYSTEMS
IVIS	IN-VEHICLE INFORMATION SYSTEMS
MAIDS	MOTORCYCLE ACCIDENT IN DEPTH STUDY
PTW	POWERED-TWO-WHEELERS
RSAP	ROAD SAFETY ACTION PROGRAMME (EUROPEAN COMMISSION)
SME	SMALL-MEDIUM ENTERPRISE
VRU	VULNERABLE ROAD USERS

## Executive Summary

The SAFERIDER project, funded within the 7<sup>th</sup> Framework-Programme of the DG Information Society & Media, aims to study the potential of ADAS/IVIS integration on motorcycles for the most crucial functionalities and develop efficient and rider-friendly interfaces and interaction elements for riders comfort and safety.

SAFERIDER targets towards a parallel and concurrent development of key functionalities, under a unified HMI concept and is expected to build upon the following steps:

- Selection of priority ADAS and IVIS functionalities, according to accident data, user needs and preferences and technological feasibility.
- Use as starting point the state-of-the-art of relevant systems on the Market as research prototypes.
- Develop further the functions, to meet the specific use cases requirements.
- Develop a common and unified HMI concept, utilising visual, acoustic and haptic elements and integrating them in different subsystems (i.e. on the panel, at a helmet, etc.); allowing each ADAS/IVIS functionality to use the best modality in an integrated and modular way and even supporting HMI personalisation to the user and context of use.
- Covering holistically the Market, by integrating the ADAS/IVIS functionalities to all types of motorcycles/mopeds (even to electric scooters), to prove their feasibility, as well as to promote the use of clean and environmental-friendly PTW's.
- Testing across Europe in riding demonstrators, off-road and on-road, with 3 PTW simulators and 6 PTW vehicles, the developed function and HMI (stand alone but also in combinations), thus proving their reliability, effectiveness, usability and user acceptance in different traffic and weather environments and user different riding and behaviour style as well as socioeconomic and cultural conditions.
- Taking in due consideration the behaviour of the other traffic (i.e. unequipped PTWs and especially cars) and the impact of the new ADAS/IVIS to the PTWs conspicuity and the conflicts with them.
- Following always a pragmatic and cost-effective approach, guided by the users' needs and wants and taking into due account market constraints.

Deliverable D10.1, entitled "Project Presentation", describes the project's concept, its objectives and expected results and provides an overview of the work to be performed within the three years of its duration. In Chapter 1, the current situation of motorcycle accidents in Europe is depicted, whereas the main problems are pointed out and the solutions proposed by SAFERIDER are outlined. Chapter 2 describes the members of the Consortium involved in the project. The main demographic data of the project are presented in Chapter 3, whereas Chapter 4 outlines the project's objectives. The technical approach to be followed is presented in Chapter 5 and, finally, the project expected impacts on European dimension is presented in Chapter 6. Annex A includes the contact information of the project's Coordinator and Technical Manager, while Annex B presents a two-page project fact sheet.

## 1. Introduction

European statistics show that Powered-Two-Wheelers road accidents are extremely high, whereas a high percentage of them are fatal. More specifically, motorcycle and moped fatalities account for 17,8% of the total number of road accident fatalities in 2003, in EU-14 member countries, whereas in 2006, a motorcycle was thirteen times more likely to be involved in a fatal accident than a car, for every kilometre travelled [2].

During the last decade, ADAS and IVIS development is one of the main research areas of the automotive industry, in order to increase safety and comfort of four-wheel vehicles. These new technologies have been already introduced in the automotive market and their evolution is definitely fast and efficient. The strategic objective of the European Commission to reduce traffic accidents by 50%, by the year 2010, is a main incentive for the evolution of these technologies, which attract the interest of the academia, industry and end-users.

Beyond the already wide research, development and commercialization of such technologies in four-wheel vehicles, the application of such technologies in motorcycles and even clean motorbikes (electric), in order to increase the safety and comfort of riders, an extremely susceptible road user group, is currently lacking behind and should be undoubtedly studied further.

However, such technologies should be designed and developed in a way that will not interfere with driving and/or annoy the rider. Two-wheelers are very sensitive vehicles (from the vehicle dynamics point of view) and any unexpected- to the rider- change in their motion could lead to loss of control. In most of the cases, loss of control results to an accident.

Therefore, the selected functionalities have to play an informative/ warning role to the rider. An LCD display, mounted in the panel area or visual/acoustic elements integrated on the helmet, could provide various information and warnings prior dangerous situations. Processed data gathered by sensor or existing accident data related to the road/ weather conditions/ vehicle speed could be used in order to warn the rider for a possible danger.

The implementation of appropriate ADAS/IVIS technologies in motorcycles might contribute to the significant enhancement of riders' safety. SAFERIDER project, launched in January 2008, aims to study the potential of ADAS/IVIS integration on motorcycles for the most crucial functionalities and develop efficient and rider-friendly interfaces and interaction elements for riders comfort and safety.

## 2. The SAFERIDER Consortium

The SAFERIDER Consortium consists of 20 participants from 9 European Countries, with high competence related to the SAFERIDER objectives, in scientific, technological and exploitation areas. More precisely SAFERIDER Consortium includes:

- Two major motorcycle manufacturers (PIAGGIO, YAMAHA);
- Four major ADAS/IVIS systems developers (AvMap, IBEO, METASYTEM, MIRA);
- One main helmet manufacturer (NZI);

- Ten major human factor departments of European Universities and Research Institutes (BAST, CERTH/HIT, CIDAUT, FHG-IAO, INRETS, PERCRO, UNIMORE, UNIFI, UNITN, UNIPD);
- One major end user representative (FEMA); and
- Two key know-how providers (Conncept Swiss, ERT).

The SAFERIDER Consortium represents in good balance all key actors in the field, namely industries (OEM's and OEM suppliers), SMEs, Research centres, Universities and End-Users. All key areas of research within the project are covered by one or more partners, which are among the leading companies or institutes in their field.

**Table 1: The SAFERIDER Consortium.**

	<b>CERTH/HIT</b> <i>Center for Research &amp; Technology Hellas/ Hellenic Institute of Transport</i>	<i>Greece</i>
	<b>UNIMORE</b> <i>Università di Modena e Reggio Emilia</i>	<i>Italy</i>
	<b>INRETS</b> <i>French national institute for transport and safety research</i>	<i>France</i>
	<b>MIRA</b> <i>MIRA Ltd</i>	<i>United Kingdom</i>
	<b>BAST</b> <i>Bundesanstalt für Strassenwesen</i>	<i>Germany</i>
	<b>FhG / IAO</b> <i>Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.</i>	<i>Germany</i>
	<b>CS</b> <i>Conncept Swiss</i>	<i>Switzerland</i>
	<b>FEMA</b> <i>Federation of European Motorcyclists' Associations</i>	<i>Belgium</i>

 <b>PERCRO</b> Perceptual Robotics Laboratory	<b>PERCRO</b> <i>Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna</i>	<i>Italy</i>
	<b>PIAGGIO</b> <i>Piaggio &amp; C. SpA</i>	<i>Italy</i>
	<b>UNIPD</b> <i>Università degli Studi di Padova</i>	<i>Italy</i>
 Foundation <b>cidaut</b> Transport and Energy Research and Development	<b>CIDAUT</b> <i>Fundación CIDAUT</i>	<i>Spain</i>
	<b>Metasystem</b> <i>MetaSystem S.P.A</i>	<i>Italy</i>
 <b>AvMAP</b> SATELLITE NAVIGATION	<b>AvMap</b> <i>AvMap S.r.l.</i>	<i>Italy</i>
	<b>UNIFI</b> <i>Università degli Studi di Firenze</i>	<i>Italy</i>
	<b>IBEO</b> <i>Ibeo Automobile Sensor GmbH</i>	<i>Germany</i>
	<b>Yamaha</b> <i>Yamaha Motor Europe N.V.</i>	<i>Netherlands</i>
	<b>NZI</b> <i>NZI Technical Protection S.L.</i>	<i>Spain</i>

	<p><b>ERT</b> <i>Europe Recherche Transport</i></p>	<p><i>France</i></p>
	<p><b>UNITN</b> <i>Università degli Studi di Trento</i></p>	<p><i>Italy</i></p>

### 3. Project at a Glance

The following table shows the SAFERIDER project data at a glance.

**Table 2: Project at a Glance.**

Contract Number	FP7-216355
Project acronym	SAFERIDER
Project Name	Advanced telematics for enhancing the <u>safety</u> and comfort of motorcycle <u>riders</u>
Project coordinator	Dr. Evangelos Bekiaris, CERTH/HIT, E-mail : <a href="mailto:abek@certh.gr">abek@certh.gr</a>
Programme	7 <sup>th</sup> Framework-Programme
Start Date	01 January 2008
Duration	36 months
Total Cost	€ 5.370.379
Further Information	<a href="http://www.saferider-eu.org">www.saferider-eu.org</a>

### 4. Project Objectives

The SAFERIDER project aims to study the potential of ADAS/IVIS integration on motorcycles for the most crucial functionalities and develop efficient and rider-friendly interfaces and interaction elements for riders comfort and safety.

SAFERIDER will approach this aim, through the following main objectives:

- To develop priority Use Cases for ADAS/IVIS implementation on PTWs.
- To define the functionalities of the prioritised ADAS/IVIS for PTWs of different levels (small, medium, high), based on accident analysis data and naturalistic driving studies.
- To design and develop ADAS/IVIS prototypes for the selected functionalities.

- To design an optimal HMI concept and develop warning/ information provision elements for the developed ADAS/IVIS prototypes, as well as for potential combinations of their output.
- To technically verify the developed ADAS/IVIS and integrate them to different motorcycles and motorcycle simulators.
- To estimate the safety impact and user acceptance of the prototypes in a series of pilot applications.
- To develop a Design Guidelines handbook for ADAS/IVIS integration and HMI design for motorcycles.
- To develop riders training tools for optimal ADAS/IVIS usage.

## 5. Technical Approach

### 5.1 Architecture

The general strategy for the SAFERIDER architecture is based on the highest integration between ADAS, IVIS and traditional functions and information. SAFERIDER architecture targets to be flexible and modular, so as to allow different ADAS/IVIS combinations and integration upon different PTW's types (i.e. ranging from big motorcycles to electric scooters). Also within the same PTW, this approach allows, with minor modifications in the design, an improvement in the numbers of new ADAS/IVIS as soon as they will become available. Moreover, the specifications of all elements and subsystems of SAFERIDER, should be drawn in a way that they meet all the three following requirements:

- compatibility between the elements/subsystems;
- interoperability towards external systems;
- easy installation and maintenance.

The conceptual architecture of SAFERIDER, which will be utilised as a starting point for the design of the overall physical architecture is presented in the figure below.

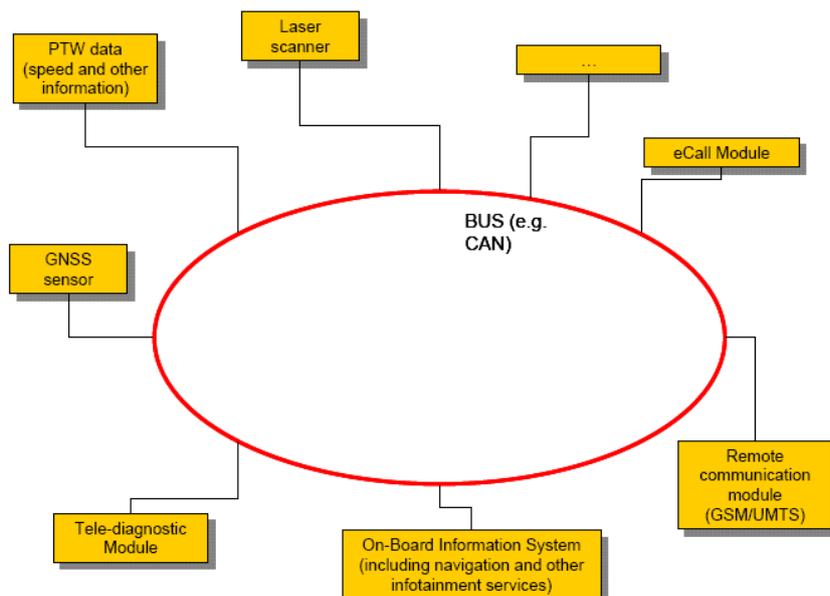


Figure 1: SAFERIDER Conceptual Architecture.

## 5.2 SAFERIDER Developments

SAFERIDER aims to design, adapt and develop eight ADAS/IVIS subsystems and their elements and integrate them in different combinations on the project demonstration vehicles. Specifically, SAFERIDER developments include:

- 🏍️ **Design and development of four Advanced Driver Assistance Systems (ADAS) applications for motorcycles with high traffic safety impact potential:**
  - **Speed Alert:** to warn the rider when the speed exceeds the legal speed limits.
  - **Curve Speed Warning:** to warn the rider when approaching speed is too high for negotiating the curve ahead.
  - **Frontal Collision Warning:** to warn the rider when an obstacle is detected in the motorcycle nearfield area.
  - **Intersection Support:** integration of the three above functionality to provide efficient warning on potential hazards in intersections.
  
- 🏍️ **Design and development of four In-Vehicle Information Systems (IVIS) applications for motorcycles of high added value to riders comfort and potential positive impact to traffic safety:**
  - **eCall:** emergency call when motorcycle crash/fall is detected.
  - **Telediagnostic Service:** remote data logger of the principal motorcycle parameters: security, anti-theft, performance, diagnostic.
  - **Navigation and Route Guidance:** provision of route information to the rider.
  - **Weather, Traffic & Black Spot Warning:** provision of relevant information to the rider.

## 5.3 Rider Interaction

SAFERIDER Human-Machine Interaction (HMI) is on the primary focus of research and development, since the interaction of the systems with the rider should be at the same time discreet and unobtrusive, as well as understandable and rider-friendly. Therefore the targeted objectives lie with:

- Developing an integrated and modular HMI solution for all applications, tailored towards motorcyclists' and riders' requirements.
- Providing warning to the rider on time and safely about possible hazards in the near future.
- Achieving of high acceptance of rider warnings with high levels of perceived usefulness and user satisfaction.
- Keeping distraction as low as possible by developing highly intuitive warning stimuli.

The potential HMI design working areas that will be studied within SAFERIDER include:

- Head Up display on the helmet providing visual output.
- In-helmet speakers providing auditory output.
- Navigation and route guidance on the dashboard and acoustically in the helmet.
- Seat Vibration.
- Haptic handle-bar.
- Force-feedback throttle.

## 5.4 Demonstrators and validation at pilot sites

The SAFERIDER developed systems are planned to be integrated and tested across Europe, off-road and on-road, in 3 motorcycle simulators and 9 motorcycle demonstrators, in order to evaluate their reliability, effectiveness, usability and user acceptance in different environmental and rider behaviour conditions.

The applications cover different motorcycle types, in order to prove the applicability of the project developments in small, medium and large motorcycles.

The Pilot sites are supported by two of the biggest motorcycle manufacturers (PIAGGIO, YAMAHA), one large Industry of automotive systems (MIRA), two Research Centers (CERTH/HIT, INRETS) and one University (UNIPD). SAFERIDER Pilot sites are expanded throughout Europe, covering different road types and riders' cultures of North (UK), Central (France, Netherlands), and South (Italy, Greece) Europe as shown in the Figure below.

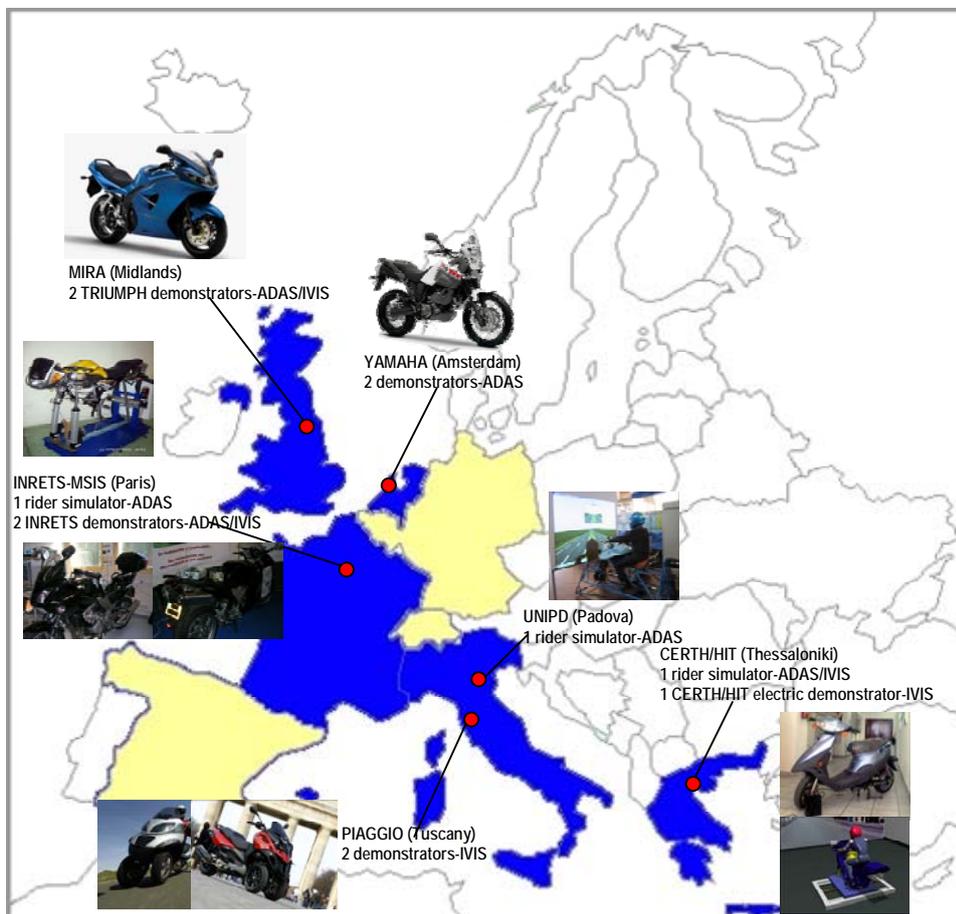


Figure 2: SAFERIDER Pilot Sites.

## 6. Expected Impact

PTW accidents are high in all EU countries. Measures to reduce them can hardly be local, as riders and vehicles wander from country to country and as the relevant Market is an international one. Furthermore, the expertise to develop a whole new Market - that of ADAS and IVIS for PTWs - surpasses by far the technological and financial capabilities of single actors or even national projects. In this respect, also the European Industry has to compete in the International Market from a non-favourable position, as several non-European manufacturers have recently entered strongly this Market. SAFERIDER brings together some of the biggest European PTW manufactures and suppliers, drawing at the same time experience from other areas (Japan), to develop interoperable, modular and low cost solutions. Moreover, the participation of FEMA and the Pilot testing in all different European areas (North-Central-South) guarantees that the developed functions and their HMI will take into account the various traffic environments, as well as socioeconomic and cultural differences across Europe. In this respect, it is also important that these functions are integrated on all types and sizes of PTWs, thus covering the needs of the overall European Market.

In technological terms, SAFERIDER is expected to advance significantly the state-of-the-art in ADAS/IVIS for motorcycles, not only through single development, but also by:

- Defining the actual needs of riders from ADAS/IVIS functionalities, based upon in-depth accident analysis, user opinion and ergonomic studies.
- Developing a holistic, modular and fusion supporting System Architecture for multi ADAS/IVIS integration on PTWs of all types.
- Developing a common, multimodal and concise warning concept and strategy for multi ADAS/IVIS functions integration, combining visual, auditory and haptic stimuli into various HMI platforms, such as wearable haptic elements, smart helmet applications and context-related HMI adaptations, according to riding conditions and events.

## 7. References

1. SAFETYNET, Traffic Safety Basic Facts 2005 for Motorcycles & Mopeds, European Commission, October 2005.  
([http://ec.europa.eu/transport/roadsafety/road\\_safety\\_observatory/doc/safetynet/2005/bfs2005\\_sn-swov-1-3-motorcycles\\_mopeds.pdf](http://ec.europa.eu/transport/roadsafety/road_safety_observatory/doc/safetynet/2005/bfs2005_sn-swov-1-3-motorcycles_mopeds.pdf)).
2. Annex I "Description of Work", SAFERIDER project, CN. 216335, 7<sup>th</sup> Framework Programme, DG Information Society & Media, August, 2007.

## Annex A: Coordinator and Technical Manager Contact Details

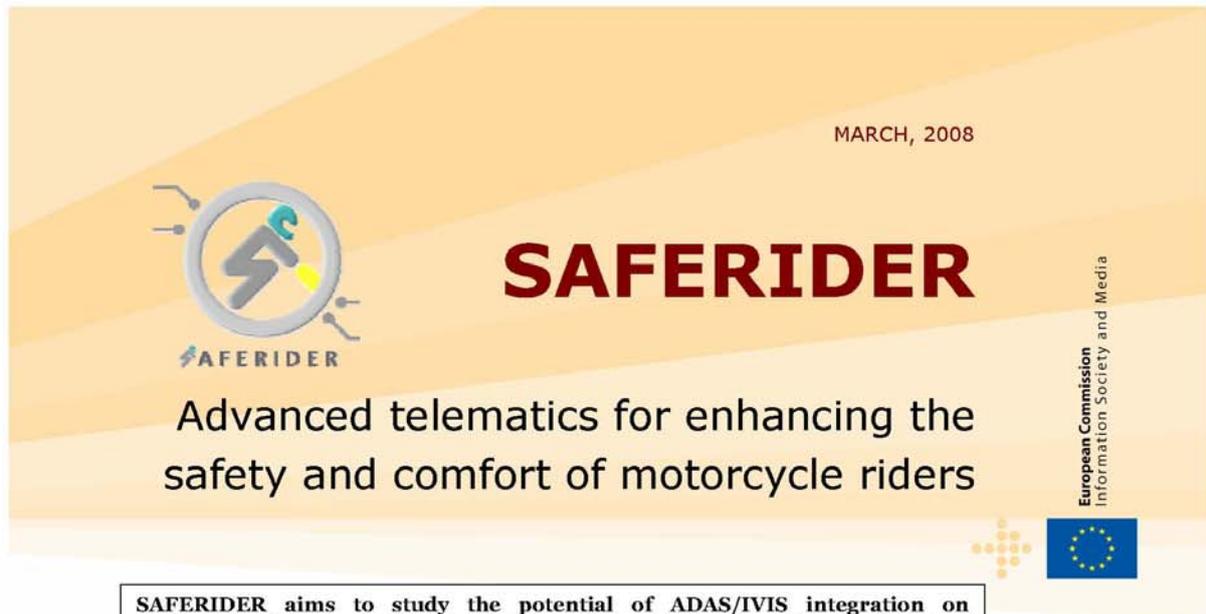
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## Annex B: Project Fact Sheet



MARCH, 2008



# SAFERIDER

Advanced telematics for enhancing the safety and comfort of motorcycle riders

European Commission  
Information Society and Media



SAFERIDER aims to study the potential of ADAS/IVIS integration on motorcycles for the most crucial functionalities and develop efficient and rider-friendly interfaces and interaction elements for riders comfort and safety.

### At a Glance

#### Project:

SAFERIDER, FP7-216355

Advanced telematics for enhancing the **safety** and comfort of motorcycle **riders**

#### Project coordinator :

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#### Partners:

CERTH/HIT (Greece), UNIMORE (Italy), INRETS (France), MIRA (UK), BAST (Germany), FHG/IAO (Germany), Connccept Swiss (Switzerland), FEMA (Belgium), PERCRO (Italy), PIAGGIO (Italy), UNIPD (Italy), CIDAUT (Spain), Metasystem (Italy), AvMap (Italy), UNIFI (Italy), IBEO (Germany), Yamaha (Netherlands), NZI (Spain), ERT (France), UNITN (Italy)

**Start Date:** 01/01/2008

**Duration:** 36 months

**Total cost:** € 5.370.379

**Programme:** 7<sup>th</sup> Framework-Programme

#### Further information:

[www.saferider-eu.org](http://www.saferider-eu.org)

### Project Overview

Riders' fatalities account for 17,8% of the total number of road accident fatalities in Europe and, in 2006, compared to a passenger car, a motorcycle was thirteen times more likely to be involved in a fatal accident for every kilometre travelled.

During the last decade, Advanced Driver Assistance Systems (ADAS) and In-Vehicle Information Systems (IVIS) development is one of the main research areas of the automotive industry, aiming to increase safety and comfort of four-wheel vehicles. These new technologies have been already introduced in the automotive market and their evolution is fast and efficient.

Nevertheless, the application of such technologies in motorcycles, in order to increase the safety and comfort of riders, an extremely susceptible road user group, is currently lacking behind.

However, such technologies should be designed in a way that will not interfere with the riding task. Motorcycles are very sensitive vehicles and any unexpected change in their motion could lead to loss of control and most probably to an accident.

The implementation of appropriate ADAS/IVIS technologies in motorcycles might contribute to the significant enhancement of riders' safety. SAFERIDER project, launched in January 2008, aims to study the potential of ADAS/IVIS integration on motorcycles for the most crucial functionalities and develop efficient and rider-friendly interfaces and interaction elements for riders comfort and safety.

1/2

## Project Objectives

The key objectives of SAFERIDER include:

- To develop priority Use Cases for ADAS/IVIS implementation on PTWs.
- To define the functionalities of the prioritised ADAS/IVIS for PTWs of different levels (small, medium, high), based on accident analysis data and naturalistic driving studies.
- To design and develop ADAS/IVIS prototypes for the selected functionalities.
- To design an optimal HMI concept and develop warning/ information provision elements for the developed ADAS/IVIS prototypes, as well as for potential combinations of their output.
- To technically verify the developed ADAS/IVIS and integrate them to different motorcycles and motorcycle simulators.
- To estimate the safety impact and user acceptance of the prototypes in a series of pilot applications.
- To develop a Design Guidelines handbook for ADAS/IVIS integration and HMI design for motorcycles.
- To develop riders training tools for optimal ADAS/IVIS usage.

## Main Activities

SAFERIDER aims to adapt selected ADAS/IVIS functionalities for motorcycles and develop the appropriate HMI for them. In total, 8 such functionalities are planned to be developed:

- **ADAS functions:** Speed alert, Curve speed warning, Frontal collision warning, Intersection support.
- **IVIS functions:** eCall, Navigation & Route Guidance, Telediagnosics, Weather, traffic & black spot warnings.

The HMI development plan is based on a common and unified concept, utilising visual, acoustic and haptic elements and integrating them in different subsystems, allowing each ADAS/IVIS functionality to use the most appropriate modality.

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## Demonstrators and Pilot Sites

The SAFERIDER developed systems are planned to be integrated and tested across Europe, off-road and on-road, in 3 motorcycle simulators and 6 motorcycle demonstrators, in order to evaluate their reliability, effectiveness, usability and user acceptance in different environmental and rider behaviour conditions. They cover different motorcycle types, in order to prove the applicability of the project developments in small, medium and large motorcycles.

SAFERIDER Pilot sites are expanded throughout Europe, covering different road types and riders' cultures of North (UK), Central (France, Netherlands), and South (Italy, Greece) Europe, as shown in the following Figure.



The Pilot sites are supported by two of the biggest PTW manufacturers (PIAGGIO, YAMAHA), one large Industry of automotive systems (MIRA), two Research Centers (CERTH/HIT, INRETS) and one University (UNIPD).