



5G-SAFE-PLUS

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Finnish Meteorological Institute, Finland

VTT Technical Research Centre of Finland Ltd, Finland

Teconer Oy, Finland

Unikie Oy, Finland

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Project Website

www.celticnext.eu/project-5g-safe-plus/

<http://5gsafepius.fmi.fi>

5G Enabled Road Safety Services

The 5G-SAFE-PLUS project aims to prevent traffic accidents and avoid casualties with 5G-enabled time-critical road safety services to vehicles and targeted road maintenance planning services. The consortium consists of partners from Finland, Luxembourg, Canada and Romania.

Main focus

An effectively operating safe road network is an essential requirement for any community. The EU has a vision of close to zero casualties in traffic by 2050. 5G-SAFE-PLUS project aims to prevent traffic accidents and avoid casualties by delivering time-critical road safety services and information to vehicles. Here, accurate weather and road maintenance information plays a key role together with direct incident/accident event information. The project supports wide-scale implementation and usage of advanced road weather, road maintenance and road safety services with enhanced 5G networking capabilities and service enablers.

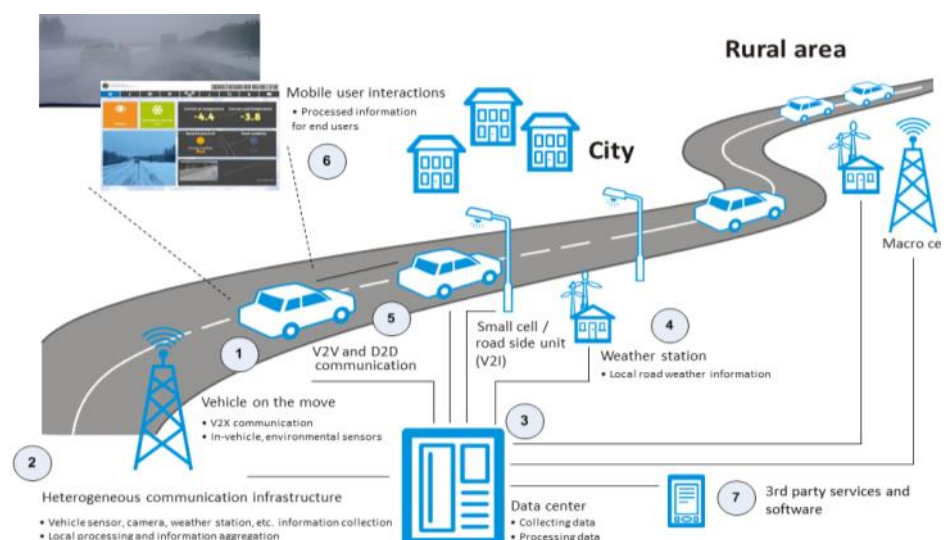
Approach

The 5G-SAFE-PLUS project aims to prevent traffic accidents and avoid casualties by delivering 5G-enabled time-critical road safety services to vehicles. Here accurate road weather, safety and maintenance information plays a key role together with direct incident/accident event information. The project supports wide-scale implementation, deployment and usage of advanced road weather, safety and maintenance services with enhanced 5G networking capabilities and service enablers.

Vehicle instrumentation data allows various advanced services and information provision benefitting the meteorological forecasting process as well as optimizing the maintaining of the roads. Similar services may be utilized by automated vehicles to enhance safety, especially in challenging weather or road conditions.

To ensure smooth transition to "5G world" and to maximize the reliability, the project considers also other types communications aiming at hybrid network environments, including 4G/LTE, 5G, ITS-G5 and satellite communication. The idea is that the vehicles are connected to each other, to the roadside infrastructure and to cloud-based services always through the most optimal means of communications. For supporting the strict real-time requirements of the envisioned services and ensuring scalability, the solution includes means for local processing (e.g. fog/edge) and information aggregation. Finally, information security and privacy play a key role as well and they will be considered by design in the overall solution.

The services and solutions to be developed and piloted in the project will use and deliver large amounts of data to different user categories. Especially the end-users need to and will be provided with ergonomic user interfaces that are user friendly, easy to use and easy to understand. 5G-SAFE-PLUS also acknowledges the existing and emerging social networks, crowd-sourcing and on-line data sharing. To support visualization and simulation a digital twin be developed and used.



Main results

The new 5G-enabled (hybrid) communication system with special services tailored for the system is the most visible result and product of the project. However, from this entity we can separate smaller elements presenting innovative results of the project. These elements consist of:

- ◆ Development, deployment and piloting of accurate and reliable road status and weather information, warnings and forecasts applications and services
- ◆ Development of a hybrid communication platform.
- ◆ Development and deployment of systems to analyse and forecast road surface condition, weather, air quality, etc. and to provide warnings of poor road sections.
- ◆ Development and deployment of friction monitoring and friction forecasting systems.
- ◆ Development and deployment of obstacle and pedestrian detection systems.
- ◆ Utilization of various sensors, sensor fusion and data analytics in innovative ways.
- ◆ Improved multi-channel road weather warning services utilising data from meteorological models and forecasts as well as real time data from road maintenance vehicles.
- ◆ Development and deployment of road weather and road Maintenance pilots” in interesting & challenging environments in participating countries.
- ◆ Simulation environment system employing 5G-SAFE-PLUS com-

munication system with different traffic conditions, alternative traffic incidents with estimation of the system operability in such conditions.

- ◆ Simulations including realistic mobility models based on real geographical and traffic data exploitation.
- ◆ Provision of applications and services supporting autonomous driving with collaborative sensing technique.
- ◆ HD Map - database consisting of static and dynamic data related to driving conditions and environment.
- ◆ Digital twin to visualize the results of measurement and collected data.
- ◆ IoT security components that can be mounted on vehicles to gather and monitor vehicle data in protected mode.
- ◆ Hardware Security Module mounted on cloud servers and then virtually connected to edge nodes for effective user authentication.
- ◆ Analysis of use cases and design the user scenarios while connected at wheel.

Impact

5G-SAFE-PLUS has ambitious impact objectives. The main goal could be summarised briefly in one sentence “we want to save lives”. For instance, in Finland there have been accidents where several people have died. Reasons for these have been unexpected and sudden changes in road weather and conditions. These accidents could not have been avoided with

mere human observations, since the weather conditions changed very quickly because of many issues that could not be detected by human eyes.

It is important to underline that operative meteorological and safety systems cannot rely on crowdsourcing, which can only be used as supporting data. Verified measurements are the mainframe of data. Thus, the ultimate goal of 5G-SAFE-PLUS is to prevent these kinds of unfortunate disasters by providing a reliable and scientific way to provide forecasts and warnings of changes to come, before they actually happen.

The strengths and also impacts of 5G-SAFE-PLUS are in several issues:

- ◆ automatic, sensor-based, objective detection of changing conditions such as temperature, moisture, wind, etc. by collecting controlled, measured, and reliable data
- ◆ using AI/ML and advanced algorithms to forecast and inform the expected and coming changes in road conditions, using advanced computing systems
- ◆ the fastest and most efficient way to pass the information and measurements to road users by using 5G communications and also hybrid communications
- ◆ to provide immediate real-time information to road maintenance organisations to prevent the dramatic changes beforehand
- ◆ to provide road users with warnings that are accurate, location based and reliable
- ◆ to support road maintenance organisations to provide accurate and effective road maintenance services and thus prevent problems and dangers on the road network
- ◆ to provide all partners with access to all the 5G-SAFE-PLUS test tracks so that all the partners will be able to test and present their results, achievements and developments in different environments

One can go out and see what is the weather and based on personal views estimate it, whereas meteorological institutes such as FMI in 5G-SAFE-PLUS are scientifically modelling and forecasting the weather with super computers.

5G-SAFE-PLUS is about using best possible tools (sensors, measurements, communications, ML, AI, algorithms, etc.) to increase safety by providing reliable, measured, scientifically correct real-time information, forecasts and warnings.

About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World“ paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies or universities and research organisations. Even

companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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