

# 5G-HEART Newsletter

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Issue No.8

**5G HEART**  
5G Health, Aquaculture and Transport  
Validation Trials

Project website: <https://5gheart.org/>

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## 1. 5G-HEART Final Event

The 5G-HEART project will organise a public Final Event in Oulu, Finland on 17 November 2022. During the past 42 months, the 5G-HEART project has developed and executed large-scale vertical trials on top of European 5G test facilities focusing on the specific needs of innovative digital services from the healthcare, transport and aquaculture vertical industries. The Final Event will present technical results and key findings from the 5G trials conducted during the project by demonstrating and introducing over 20 specific use case scenarios from targeted vertical domains.

The day will be divided into three special sessions, each focusing on one of the project's target verticals. The first half of each vertical specific session will be dedicated to an overview presentation that summarises the key trialling activities performed during the project and highlights selected vertical use cases with demonstrations on the main stage. The second half of each vertical specific session will be dedicated to more informal discussions and networking as the Final Event audience can visit the project's demo booths and discuss in more detail with the research groups that conducted the trials during the project.

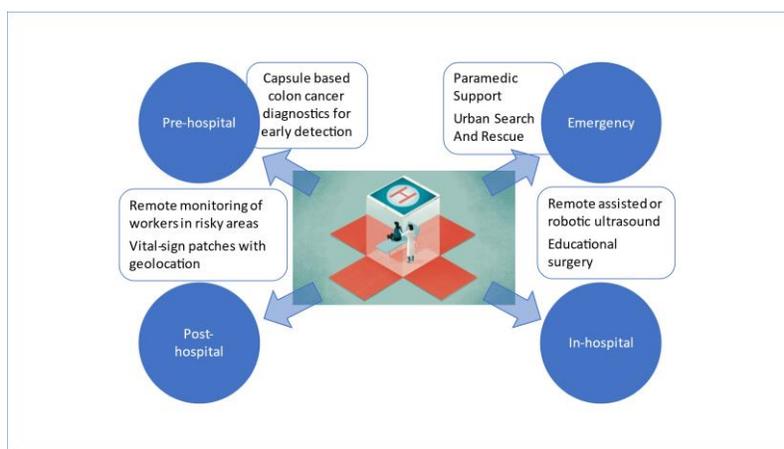
This issue of the 5G-HEART Newsletter focuses on the healthcare vertical and some of its key use cases and trials to be presented in the Final Event. Registration to the event is open at [https://www.lyyti.fi/reg/5GHEART\\_6333](https://www.lyyti.fi/reg/5GHEART_6333).

## 2. Healthcare vertical trials

E-health is identified as a priority in the European digital agenda, but it puts strict requirements on ICT in terms of latency, reliability, bandwidth, security, and mobility. On this backdrop, 5G and healthcare is a good match, since 5G can provide essential levels of connectivity to enable a new health system. It could also transform and improve all critical components of healthcare. 5G can support the transformation of the healthcare sector from volume-based to value-based care and is essential to build the “digital base” in healthcare by providing network security and data privacy, which are paramount for healthcare.

The healthcare vertical trials in the 5G-HEART project are structured under three high-level use cases divided into nine subcases. The H1 “Remote Interventional support” focuses on using remote assisted or controlled ultrasound, advanced video, and augmented reality in different clinical situations. The subcases of this use case comprise “Educational surgery”, “Remote ultrasound examination - Congenital heart disease”, “Remote ultrasound examination - Robotics”, “Paramedic support”, and “Critical health event”. The H2 “Automatic pill camera anomaly detection”, comprise one subcase focused on developing a colon wireless capsule endoscopy system with automatic polyp detection for early detection of colon cancer with high mortality. The H3 “Vital-sign patches with advanced geolocation” focuses on the development of a prototype single-use vital-sign patch and accurate geo-location technology. It includes the subcases “Vital-sign patch prototype”, “Localizable tag”, and “Aquaculture remote health monitoring”.

The overarching vision of the healthcare use cases is to investigate how to realise a “Hospital without walls”, using 5G technology. The healthcare vertical trial use cases cover almost all situations in healthcare delivery both in- and outside the hospital as shown below.



The healthcare trials have been conducted in four locations utilizing the 5G-VINNI (Oslo, Norway), 5G-EVE (Athens, Greece), 5GTN (Oulu, Finland) and 5Groningen (Groningen, Netherlands) test facilities. Some trials have also been conducted by using commercial 4G and 5G in Norway and the Netherlands, and by utilizing a LPWA test network in Grenoble, France.

### **3. Healthcare trial videos**

Several videos focusing on the 5G-HEART healthcare vertical use cases have been prepared to demonstrate the implementations of the final trials as well as to present key results from them. A short summary of the videos is presented in the subsections below. The videos can be found from the 5G-HEART website at <https://5gheart.org/dissemination/videos/> and directly from the project's YouTube channel by following links provided for the different videos below.

#### **Use case H1A – Educational surgery**

Advanced 5G technology with real-time video can extend in-hospital coverage and enable faster reaction times. It can be used for primary treatment, novel and safer ways for consulting and education. The 5G-HEART project studied the feasibility of using 5G in educational surgery using advanced mobile video solutions.

The objectives for this use case included the application and network level feasibility testing of 360-degree single lens cameras and wearable camera technology in remote education utilising live streaming, testing and verification of the benefits of 5G in live low latency streaming, and piloting of the use case in real hospital environment.

A video titled “Educational surgery” (<https://youtu.be/dhd6zBD4lhc>) presents the final trials and key findings from this use case.

#### **Use case H1B – Remote ultrasound examination**

Ultrasound examination of the heart is a complex task, demanding substantial experience from the healthcare professional to correctly perform and interpret the examination. In smaller healthcare centres, the availability of these trained and experienced healthcare professionals is scarce, especially outside of daytime. Neonates with signs and symptoms warranting ultrasound examination of the heart are born in healthcare centres across the globe at a steady pace. This creates the problem of meeting the demand for ultrasound examinations of the heart, compared to the supply of healthcare workers competent of properly performing the examination.

The objectives for this use case included the assessment of remotely guided ultrasound of the heart, over the cellular network, where an expert in cardiac ultrasound can sit in one geographical location and give an experienced opinion to a colleague examining a patient elsewhere. In addition, a tele-operated robotic system using master-slave configuration to perform ultrasound examinations of the heart in a similar setting was developed with the remote expert sonographer manipulating the robot via 5G connection.

A video titled “Remote ultrasound with 5G” (<https://youtu.be/qGaidYEjmBA>) presents the final trials and key findings from this use case.

## **Use case H1C – Paramedic support**

Ambulance services are striving towards healthcare with higher quality and possibly better cost-effectiveness. Increasingly more and more ambulance services wish to improve pre-hospital triage, and for this purpose it is important to make correct and timely decisions in emergencies. The Chief Medical Officer (CMO) of an ambulance service may be remotely consulted for decision-making in rare or difficult emergency situations. If a paramedic can use wearable video-audio and share a patient's vital parameters or even ultrasound images, the remote CMO can see the same patient context that the paramedic sees, help accelerate diagnosis and improve decision-making. This will lead to accelerated patient treatment, improved outcomes, reduced travel, cost savings and higher efficiencies.

The objectives for this use case included the application-level testing and verification on how usable remote video services are for use by ambulance professionals, testing and verification of how well 5G may deliver the related video traffic, and testing and verification of how 5G network slicing may guarantee radio network resource for the delivery of video traffic in co-existence with other competing traffic.

A video titled “5G for remote paramedic support” (<https://youtu.be/f5fxYYQEII8>) presents the final trials and key findings from this use case.

## **Use case H1D – Critical health event**

As a part of the 5G-HEART project, a pilot was conducted to evaluate if wearable video can improve decision-making and outcomes in Urban Search and Rescue (USAR) scenarios. The pilot was conducted with paramedics especially trained in USAR. During the pilot, commercial networks were used for internet connectivity in the Oslo area.

The objective of the pilots was to support paramedics playing the roles of searchers and technicians with remote incident commanders. In the pilot, the incident commander could see the situation through the searcher's eyes and was able to interact with the searcher. The live point-of-view video enabled the remote commander to immerse themselves in the situation. As a result, the remote commander could supervise and support the searcher with improved decision making.

A video titled “Urban search and rescue” (<https://youtu.be/jaWgV5LZA9A>) presents the pilot and key findings from this use case.

## **Use case H3A+B – Vital-sign patch prototype + Localizable tag**

A Direct-to-Cloud (D2C), vital-signs patch is a smart band-aid that measures a patient's vital-signs 24/7 and communicates these directly through the cellular network. This way doctors can keep a tab on their patients, no matter where they are, potentially supported by AI algorithms running in the cloud.

The key objective was to assess the feasibility of the D2C vital-signs patch concept, addressing the key challenges of battery life and coverage. An additional objective was to evaluate the feasibility of a reliable and low cost, low power localisation technique to complement the cloud connectivity of the vital-sign patch prototype. The experimental work focusing on both of these objectives included rigorous measurements with variety of radio access technologies to verify the performance and trade-offs related to the use case KPIs.

A video titled “Remote patient monitoring with wearable sensors” (<https://youtu.be/dN9oOZFWZD4>) presents the final trials and key findings from these two use cases.

## **Use case H3C – Aquaculture remote health monitoring**

Health status and safety of workers within the aquaculture industry, particularly in low- and middle-income countries, has not been given due importance to date. Farm hands and other workers in aquaculture are susceptible to many occupational diseases and injuries in the course of their work. The remote health monitoring system trialled in the 5G-HEART project aimed at providing real-time monitoring and constant situational awareness of the health status of the workers and/or vulnerable people in remote locations, such as aquaculture sites.

The objectives for this use case included the performance testing and trialling of individual intelligence system components as well as the overall system. The remote health monitoring system included a variety of wearable devices at the user side, intelligence for identification of current issues, forecasting of future issues and health emergencies at the system side, and a dashboard for providing the health care professionals with visualisation of health monitoring data, notifications and alerts.

A video titled “Aquaculture remote health monitoring” (<https://youtu.be/5iDjkxcQ2m4>) presents the final trials and key findings from this use case.

## **4. Summary**

This issue of the 5G-HEART Newsletter focused on the upcoming 5G-HEART Final Event and provided an overview to the healthcare vertical trials that will be presented in more detail during the event on 17 November 2022. This issue of the newsletter also introduced a selection of use cases from the healthcare vertical with links to videos highlighting the implementations of their final trials and achieved key results.