

# German Research Center for Artificial Intelligence use Perle for data transmission to create virtual reality (VR) environments

*The ultra-low-power design of Perle IRG Routers and IDS Switches make them ideal for use in the battery powered mobile sensing platform.*

Crop variety plot trials are used by seed manufacturers to assess and develop types that are sustainable, disease resistant, and deliver the best yield. These trials are expensive and labor intensive because they require continuous monitoring to determine quality based on plant characteristics such as height, volume, and coloration. Therefore, researchers at the German Research Center for Artificial Intelligence (DFKI, Deutsches Forschungszentrum für Künstliche Intelligenz) are developing a virtual breeding garden to test the use of automation and virtual reality (VR) in crop variety plot trials as part of the research project PORTAL (28DK111B20) funded by the German Federal Ministry of Food and Agriculture.

DFKI has created a mobile sensing platform that consists of a battery-operated robot based on the Saga Robotics Thorvald Platform, named Valdemar, and a base-station container where Valdemar is protected from storms and vandalism while it uploads data and recharges the battery.



Gut Arenshorst © DFKI, Annemarie Papp

Valdemar can travel over 4km in a recording campaign, covering an area of approximately 6,000m<sup>2</sup>, to capture around 2 Terabytes of data about plants at various stages of development using multiple sensors and cameras. This data is compressed and processed within the base-station container and then uploaded to the cloud-based data center over 5G for further processing to create a three-dimensional map of the breeding garden within a VR environment.

*“The use of VR technologies opens several new possibilities, such as the immersive inspection of the plots, regardless of the trial location and cultivation period. Furthermore, the rating of plants in a virtual breeding garden opens the potential for interactive machine learning since the information can be saved and labelled for the creation of data sets. Automation or recommendation systems can be developed on this basis.”*

— Christoph Tieben Team Leader Robot-Control at DFKI

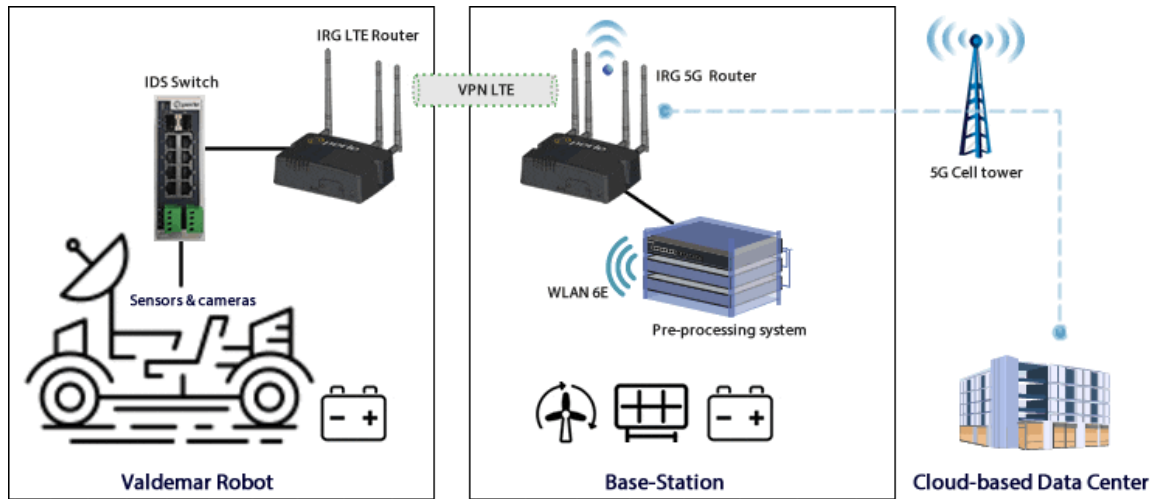


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Valdemar, the first issue was to connect the various sensors and cameras for data collection. The **IDS-305-XT Industrial Ethernet Switch** was selected for its compact size that fits into the constrained space, as well as its ability to operate in an environment subjected to vibration, shock, and -40°C to 75°C temperatures. The IDS-305-XT plays a critical role in the backbone network by enabling real-time clock synchronization of individual control components and ProfiNet support for the integration of a fail-safe PLC. The second issue was the data upload to the base-station container followed by transmission to the cloud-based data center.

Tieben explains, *“Because Valdemar is **battery operated**, and the base-station container is **solar and wind powered**, the equipment installed needed to consume as little power as possible. For this job, we tested cellular routers from Perle, Cradlepoint, and Sierra Wireless. **Perle’s power consumption was half of the competitive products**. That, along with the fact the Perle did not have the SIM card recognition issues that we experience with the others, made our decision to choose the IRG Routers easy.”*

**Perle IRG Routers** are designed to operate on limited power sources by consuming less than 1 Watt in idle mode and 52mW in standby mode. This makes them ideal for battery, solar, and wind powered applications. They also meet all the environmental requirements with a small form factor, rugged die-cast aluminum IP54 enclosure, shock and vibration resistance certified to MIL-STD-810G, and -40°C to 70°C operating temperatures.



An **IRG5541+ LTE Router** is installed on Valdemar and an **IRG7440 5G Router** is located inside the base-station to maintain a continuous VPN LTE connection between the robot and the container. When Valdemar returns to base-station container, the data is automatically transferred using a local WLAN 6E network. The base-station processing equipment compresses and reduces the data before it is uploaded to the cloud-based data center overnight using the Perle IRG7440 5G Router.

**About Deutsches Forschungszentrum für Künstliche Intelligenz**

The German Research Center for Artificial Intelligence (DFKI) has operated as a non-profit, Public-Private-Partnership (PPP) since 1988. Today, it maintains sites in Kaiserslautern, Saarbrücken, Bremen, Niedersachsen, laboratories in Berlin and Darmstadt, as well as branches in Lübeck and Trier. DFKI combines scientific excellence and commercially-oriented value creation with social awareness and is recognized as a major “Center of Excellence” by the international scientific community. In the field of artificial intelligence, DFKI has focused on the goal of human-centric AI for more than 30 years. Research is committed to essential, future-oriented areas of application and socially relevant topics. Currently, with a staff of about 1,460 employees from more than 65 countries, DFKI is developing the innovative software technologies of tomorrow. The financial budget was 76.3 million euros in 2021.

