Introduction

During the farming season the Farmer may encounter problems with their machinery. Agricultural machinery is often a combination of several independent machines connected and working together (working sets). In modern highly automated farming equipment the number of devices in a working set may be large. Figure 1 shows an example of modern precision agriculture working set, which has nine devices connected to the working set. If there is a fault or failure in one of the devices the whole machine combination can become affected. The fault can lead to sub-optimal performance, increase the workload of the operator, or in worst case halt the operation. Finding where the fault is a difficult task as the sources of faults are usually not visible. The season in which agricultural equipment is used is short and hectic. A day’s delay in the work can in worst cases mean a week’s delay in harvest and increases the risks of crop losses. The fault can happen in any place – in the farming center or in the fields – so it is important to get assistance quickly to the right location, with the necessary tools.

Methods

CLAFIS system offers means to connect devices that monitor CAN bus traffic within the working set. These devices, called gateways can collect information from the machine bus and transfer it to CLAFIS platform to be used by various services. These devices can capture the identity of each node in ISO 11783 network. ISO 11783, also known as ISOBUS is a data exchange network between agricultural machines. The identity or NAME in ISO 11783, contains node’s manufacturer, its function and serial number. This information is captured by the gateways. The arrangement is illustrated in Figure 2.

Gateways also collect fault codes transmitted by the nodes in ISO 11783 diagnostics messages. These messages can be tied to NAMES of the nodes and so identified which node has which fault codes active. The device NAMES and their associated fault codes are stored in Base 64 encoded device discovery records, which are stored in CLAFIS platform.

Results

The Remote diagnostics service was realized using Wapice’s IoT–Ticket device as the gateway. The gateway was connected to tractor – seed drill combination, consisting of Valtra T163 tractor and Junkkari Maestro 300 Plus seed drill. The gateway was connected to ISO 11783 network using the in-cab connector in tractor’s cabin. A simple web service was created that fetched machine information, its location and device discoveries and displayed them on a web page. Figure 3 illustrates the realized system. The diagnostics service is completely independent of the machinery and can be used with any make or model, as long as they implement ISO 11783.

Discussion

It was possible to create a simple remote fault diagnostics service using CLAFIS platform. The service was demonstrated to farmers and it was found useful already as it is. How ever it was noted that the information provided by the system was very basic and for example it was not possible to have meanings for different fault codes. The service could be extended if it is possible to connect other external systems. For example if manufacturer’s could provide information about the interpretation of fault codes the service could be extended to providing advice for solving the problem. Also Agricultural Industry Electronics Foundation AEF keeps a database on the know connectivity problems between different equipment. If that information would be brought in to system it could also trouble shoot problems not discovered solely through fault codes. The system could also work two ways, providing manufacturers information about the encountered problems and could help in product development and after sales. Figure 4 illustrates the extension possibilities of the system.