DRIVER ASSISTANT SYSTEM

1. Organisations involved

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2. Description of the case

2.1. Introduction

Workplace transport is one of the main causes of fatal injuries sustained by agricultural workers. According to HSE transport related incidents resulted in 113 deaths over a ten-year period (1998/1999 to 2007/2008). Being struck by a tractor was the most common cause of fatal injuries to workers (including the self-employed) resulting in 48 deaths (26% of all fatalities)[1]. Many accidents happen during peak periods of agricultural work such as harvest time, when the workload is heavy.

Agriculture in Europe is typically very much family-oriented and so family members are also at risk of being run-over or crushed by agricultural vehicles. It is often difficult to separate living areas on family farms: children who live on the farm and older farmers who continue with active participation in the day-to-day running of the farm are particularly at risk. The young can have poor hazard awareness and may not recognise potential danger, while the elderly have reduced agility to escape from a hazardous situation.

Modern agricultural vehicles get larger and more efficient, but also in some respects more hazardous to workers. For instance, large vehicles have gigantic blind spots (see Figure 1). Drivers have a limited field of view caused by the design of the vehicle. The most dangerous blind spots are near the wheels, behind and beside the trailer machinery and directly in front of the tractor bonnet2.

When pedestrians approach or are close to a vehicle, they may not be visible to the driver and can be run over as a result. Children are especially at risk, as they may not be seen due to their small size. However, workers assisting the tractor operator may also be run over while attaching an implement to the tractor or carrying out maintenance on the implement3.

Figure 1: Blind spot of tractors (Source: Quendler, E)

The Institute of Agricultural Engineering developed an electronic system which warns the driver when persons enter the dangerous zone around agricultural vehicles: the *Driver Assistant System*.

2.2. Aims

The D*river Assistant System* was developed mainly to protect children on farms. Children are at particular risk of being run over by agricultural vehicles. Every year children suffer severe injuries caused by tractors or other agricultural machines. The aim of this project was to develop a safe and instant electronic device (sensor) to detect children with an acoustic warning signal. However, the driver assistant system can help to prevent run-over and crushing accidents caused by agricultural vehicles to all agricultural workers, maintenance workers, seasonal/migrant workers, family members and visitors.

2.3. What was done, and how?

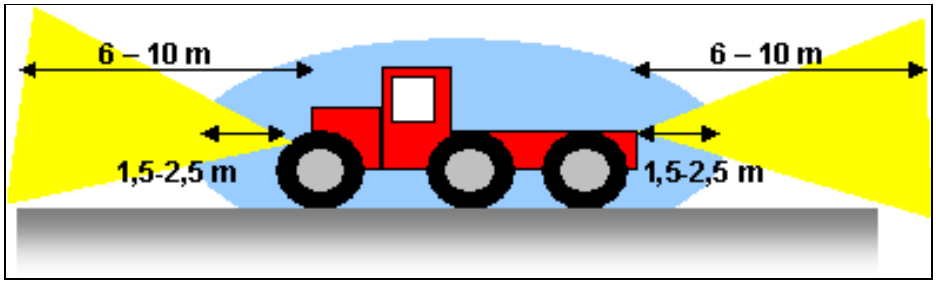
An initial search was carried out to identify an electronic system, similar to a keyless entry system, which warns the driver when a person reaches the hazardous field around and under running agricultural vehicles and machines. The criteria were:

- The need for a mobile transmitter receiver
- The ability to detect persons wearing a transponder over a distance of at least 5 metres in front of and beside the vehicles and machines
- The ability to warn drivers by an acoustic and visual signal
- The ability to warn drivers of multiple individuals around the vehicle
- The ability to inform drivers when individuals move in and out of the dangerous zone

The best solution identified was a combination of two different technologies:

- Electrical near-field technology was chosen to detect objects surrounding vehicles and machines (blue zone).
- Sensor network technology, based on radio waves, was selected for indirect recognition over larger distances (yellow zone).

Figure 2: Functioning principle of the driver assistant system (Source: Quendler et al. 2005[4])



The principle of electronic near-field communication is based upon the fact that all electricity conductors (metal) produce an electromagnetic field near the ground. The electric “aura” of the transmitter takes all parts of the tractor and possible attached machinery into account, leaving

no “dead” areas. The “aura” of the human body communicates via the transponder with the base sensor on the vehicle[5] (Quendler et al., 2006).

Radio sensor networks have been successfully integrated into industrial automation. The sensor network is able to cope with distances of up to 50 meters. Multiple transponders can operate on separate vehicles simultaneously, each one using an unambiguous identification number. One of the most important advantages of sensor nodes is their low power consumption requirement. Radio technology relies upon the direction of ultra-short waves and can be susceptible to detection gaps in the immediate surroundings of vehicles due to certain shading and reflection effects. These gaps are closed through combination with the electrical near-field system[6].

The prototype of the combined system was tested by farming families who were especially interested in electronics (technophiles). The test vehicles were medium and large in size and had various machinery attached to them. The *Driver Assistant System* consisted of three components: a transponder, a base module with an alarm unit, and a near field source.

2.4. What was achieved?

Prototypes of the *Driver Assistant System* were built and tested. Usability assessments were conducted over several months to identify the advantages and disadvantages of the prototypes.

A website was initiated by the non-profit organisation ARGE Zeno to support the project financially by raising funds (http://www.landwirt.com/lisa_schutzengel/zeno.html) (accessed 28/10/10)

2.5. Problems faced

The realization of the original concept was not easy and more complicated than assumed and required intensive cooperation between industry and science.

The prototype of the driver assistant system was tested by farming families for several months. The results of the evaluation showed that additional development was necessary:

- The far field sensor had a range of up to 40 m, leading to increased false alarms which were partially reduced by the farm yard shading effects caused by buildings, etc.
- The breaks between far-field warning signal tones were too long, and the signals for both near- and far- fields were not audible enough during loud work processes.

2.6. Success factors

Many farming families accept that there is a need for the *Driver Assistant System* and the demand for such a device is thought to be high. The transponder can be integrated in clothes, watches, bracelets or necklaces. The transponder is non-active outside the hazard zones and active in the hazard zones.

2.7. Further information

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2.8. Transferabilty

The Driver Assistant System is designed to be retrofitted to any vehicle and will be equally beneficial to other industries that use workplace vehicles.

3. References, resources

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