

Implementation of sensor technique to provide numerical feedback to modernise the operation of a Farmax spading machine.”

In this research a possible solution for measuring the spading depth during operation is developed. Since the problem consists of several individual components, a bottom-up design approach is utilized. In this process all required components are developed individually, and then put together to form the overall system. In order to ensure compatibility, an integration plan is used.

In order to measure the spading depth, a sensor is required. From several proposed solutions, a specific sensor is chosen that fits this problem the best. This is mainly for the certain sensor can measure distance without contact. Also the chosen sensor can measure distances through vegetation, making it ideal for this application. It experiences no interference from dust or alike, and is IP67 waterproof and shock resistant, making it a rugged solution. The sensor should be located such that it is not in the way of operation, and has as little change of damage as possible. Also the sensor should be located such that the angular movement of the spader resulting from a small degree of freedom, does not influence the measurement.

The analog signal from the chosen sensor should now be filtered to make it more stable, and better readable. From three proposed digital filters, a single filter was chosen. This filter averages the raw analog signal, making it more stable. The signal lowers the impact of an individual measurement, removing a great part of the signal noise.

In order to use this signal on an ISOBUS compatible screen, it needs to be translated into the right signal. In order to do that an Electric Computer Unit (ECU) is utilized. The ECU will perform the filtering action, and convert the signal into a usable signal for the ISOBUS compatible screen. The ECU also sends the information on the visual aspect of the interface to the ISOBUS screen. For this concept it is chosen to use a freely programmable ECU. This way, Farmax can program the ECU fully to the needs of their spading machine.

Integrating the components into a system is done by connecting all components with the right wire connections. When the ECU is programmed, assembly is straightforward. When the connections are made correctly, it can be plugged into the ISOBUS connector, and the operator has to perform no extra tasks. To prove this a prototype was developed. The prototype clearly showed the ease of use.

In order to prove to Farmax that the theoretical concept is feasible, several tests have been performed. These tests were run using a substitute sensor due to cost efficiency and availability. The tests have shown how the sensor reacts to different surfaces, and that it is possible to measure spading depth whilst spading. They have however not yet shown whether it is possible to perform these measurements within the required specification. Since the end product will use another type of sensor, it would be best to continue test with the real proposed sensor.