

Ultrasonic density measurement of agricultural crops

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GOAL OF THE STUDY

The aim of the study is to verify the possibility of calculating the amount of biomass by measuring the density of a crop with an ultrasonic sensor.

METHODOLOGY OF THE INVESTIGATION

The measurement of the crop density was performed with AE. The measuring element chosen for the experiment is the UT2F/E7-0EUL Ultrasonic Proximity Sensor.

MAIN RESULTS FROM THE STUDY

A graph of the obtained values of the sensor output in voltage during the test is shown in Fig. 1. The measurement interval is one second. The sensor was manually passed through the winter wheat crop.

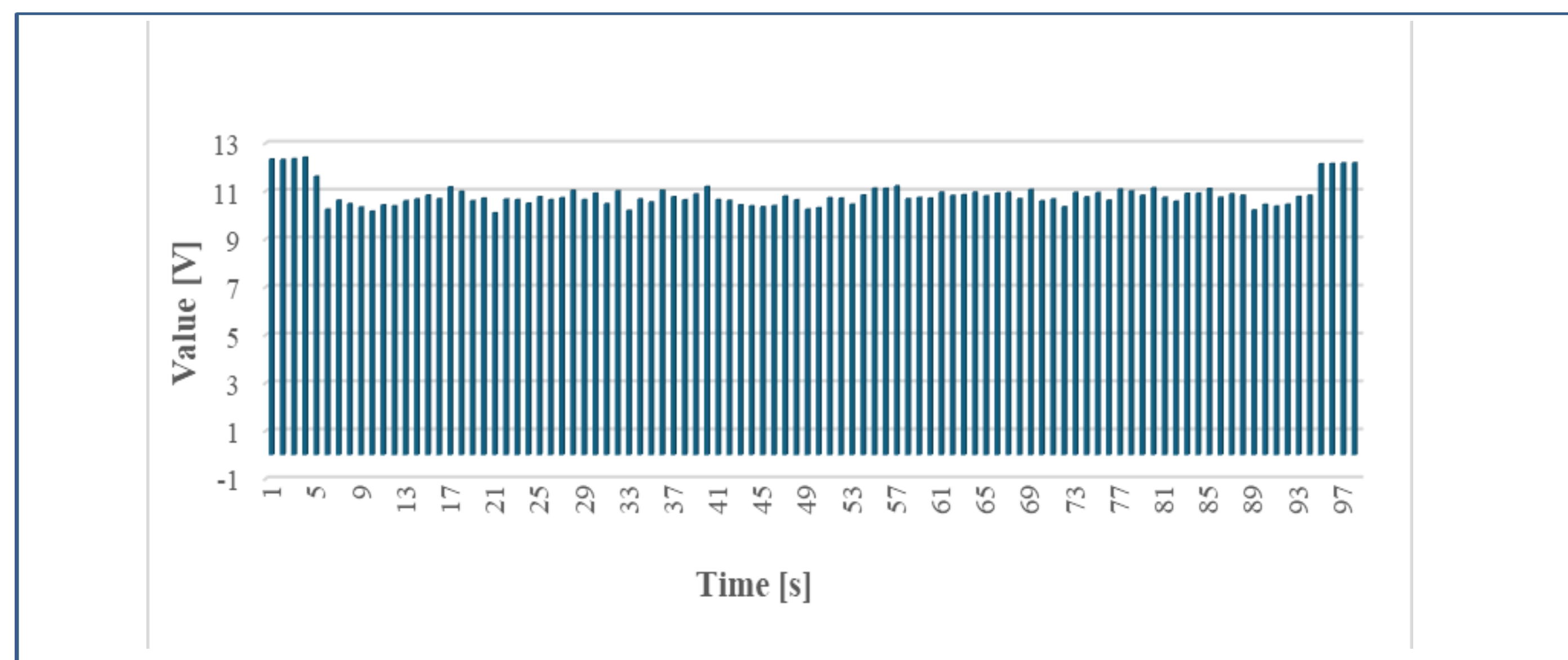


Fig. 1. Graph of the obtained values in voltage at the sensor output.

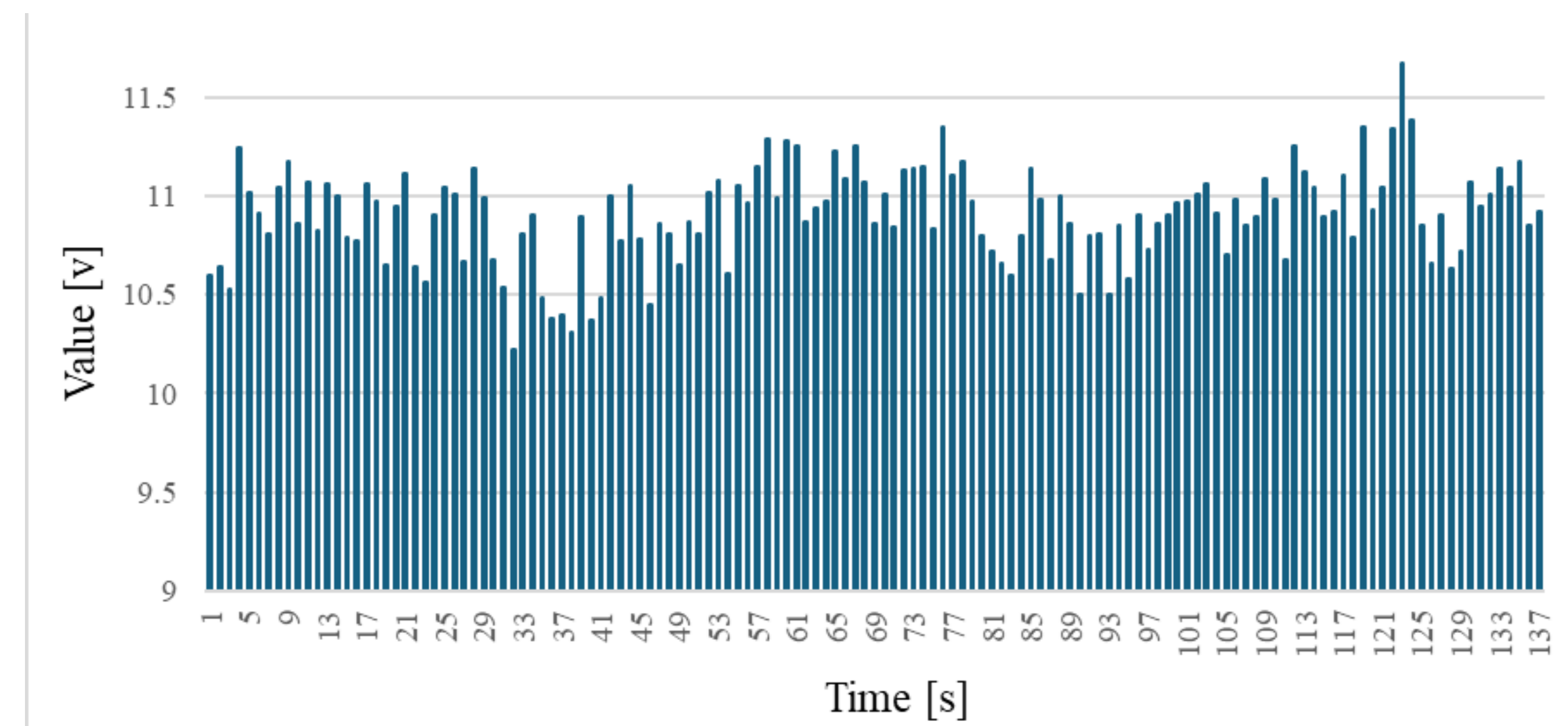


Fig. 2. Graph of the obtained voltage values over an interval of 3s and a speed of 5km/h.

The result of a test for determining the seed density at a fast passage with a speed of 5 km/h and a reading interval of 4 (s) is shown in Fig. 2.

In crops with different densities in the row and between the rows, it is important in which direction the measurement is made. In the tests, the measurements are made in a row. When measuring with the inter-row distance, the gap without crops must be taken into account and this must be taken into account in the calculations.

RESULTS ANALYSIS

A linear regression analysis of the relationship between the output voltage obtained from the sensor (Y) and the measured density of the 30 cm layer of wheat stalks (X) was performed

It is visible that Multiple R = 0.999 and R Square = 0.999. This shows a 100% dependence of the result. The obtained value for Standard Error is 0.415, which is the average distance of variation for the observed values from the regression line.

CONCLUSIONS

The working hypothesis that it is possible to determine the amount of biomass by measuring the crop density has been confirmed. When measuring in the ear area by assessing the ear density, it is possible to predict the yield of wheat.

The methodology gives correct results even when passing at high speed, since the maximum sensor response time is 0.6s and the speed of the boom in the air is about 330m/s.

ACKNOWLEDGMENT

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