2022 8th International Conference
on Energy Efficiency and Agricultural Engineering
EE&AE 2022

30th June - 2nd July 2022, Ruse, Bulgaria

Optimizing the operation of the LiDAR sensor

Constantin Daniel Oancea
Faculty of Electronics, Telecommunications and Information Technology, University Politehnica of Bucharest
Bucharest, Romania
daniel.oancea@upb.ro

GOAL OF THE STUDY

Responsibility for environmental protection belongs to man and has led to a number of actions at various levels (global, continental, regional / zonal, national, local). To achieve this goal, the development of an environmental monitoring system with improved features is a solution. The innovative character is related to the use of a LiDAR (Light Detection and Ranging) distance type sensor to monitor the environment, more precisely to track the physical changes that may occur. The objectives to be achieved in this paper are related to the establishment of a method for adapting the signal from a LiDAR sensor, used to be integrated in a sensor network. Practical solutions to ensure a stable sensor signal are identified and analyzed.

METHODOLOGY OF THE INVESTIGATION

The information provided by a LiDAR sensor is for measuring distances. A common application is mapping. LiDAR is implemented using modulated laser beams and a laser detector to measure with high accuracy distance to objects. LiDAR sensor can be an additional method of tracking possible changes in the environment (deforestation, natural disasters).

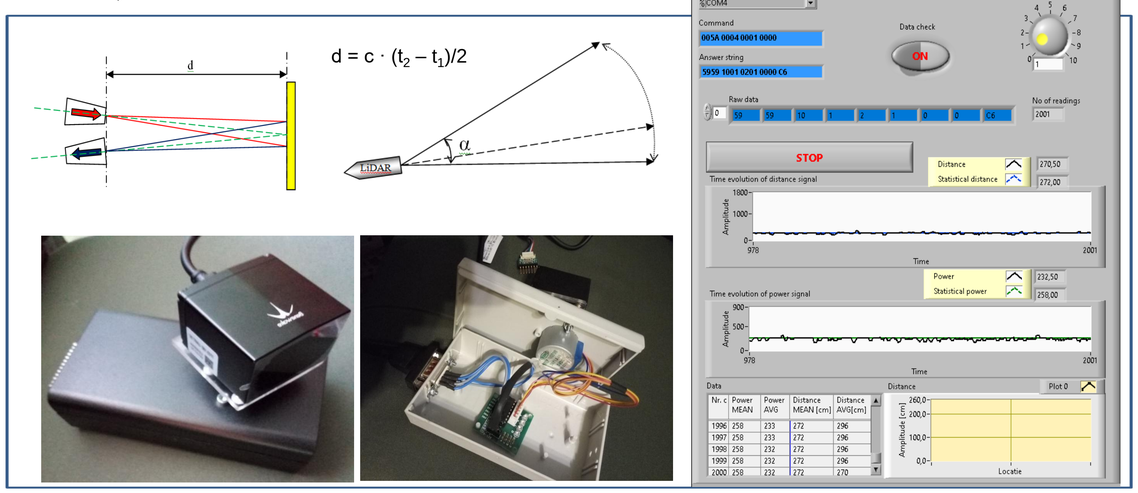

Fig. 1. LiDAR sensor (principle and mechanical aspect) and raw data (distance and power)

MAIN RESULTS FROM THE STUDY

5-wire unipolar stepper motor when the motor runs in full step mode, each step corresponds to a rotation of 11.25°. That means there are 32 steps per revolution (360° / 11.25° = 32). If it'll be used at half step mode a step angle of 5.625 degree is achieved. Because it has a reduction gear (around 1/64), actually, the final step angle is about 0.084 degree.
We talk about average value when use arithmetic formula and we talk about mean value when approaches statistical formula (median).
Classical way to compute average of a numbers is arithmetic formula. But results is not acceptable. The median value of the set of input data points was considered as second method. Must be specified sample length and by sorting the values of the newest set of input data points and selecting the middle element(s) of the sorted set of data points.

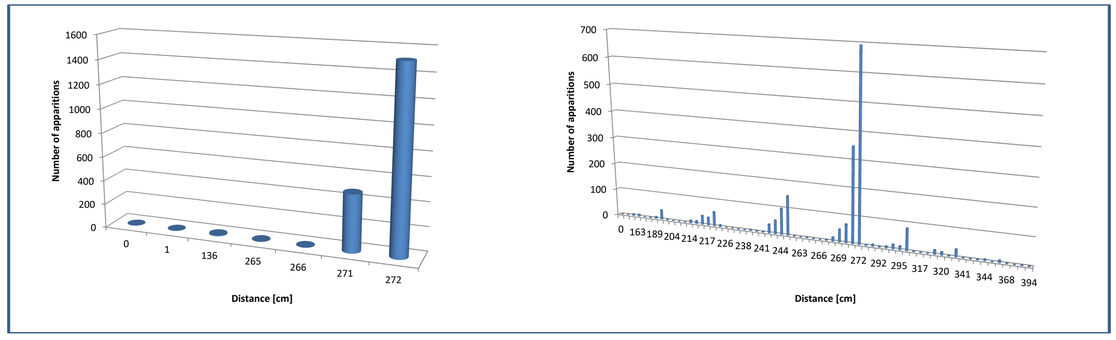

Fig. 2. Median (left) and average (right) results

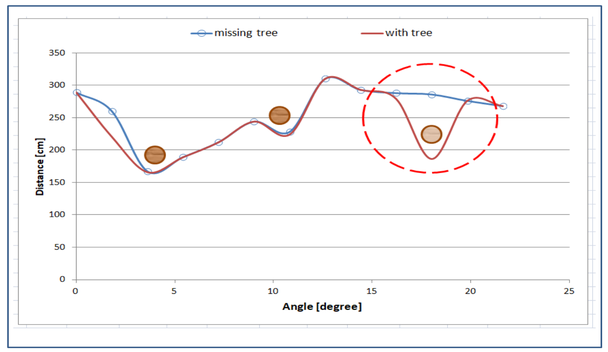

Fig. 3. Real data and highlighting differences (distance with tree and without tree)

CONCLUSIONS

This paper is related to the use of the LiDAR sensor to monitor the forest, the changes that occur in it. The problem was about the signal processing from this sensor, which is very inconsistent. The great variability of the signal comes both from external causes of the sensor (mechanical hysteresis for example) but especially from its mode of operation. Thus the sensor correlates the emitted power with the measured distance. The method found to have the most stable signal is a statistical method (median), with very good results. The fact that it uses simple operations ensures this robust method and a low calculation time, and can be implemented very easily.

ACKNOWLEDGMENT

This work was supported in part by the European Commission through Asociación de Empresas Tecnológicas Innovalia under HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME, Grant DIH-World and by Tesagon International SRL. Project: Monitoring environmental parameters and human influence in forest areas (MEPHIFA).