Design and Optimization of the Wood Splitting Process through an Ergonomic Log Splitter

Robin Henckens Roy Brouwers

Bridging programme for Master of Electromechanical Engineering Technology

Situation

Log Splitter Development for Henckens Agricultural Company

The log splitter is being developed for Henckens Agricultural; a farm were fallen trees and thick branches regularly need to be processed into firewood. This wood is often scattered across fields as shown on figure 1, or along forest edges after storm damage, old age, or pruning work causing an obstruction. The log splitter will therefore be used directly on-site, where mobility and rapid deployment are important.

Usage and Timing of the Machine

The machine is used when new wood accumulates, such as after heavy winds or periodic maintenance of the site. At these times, there is a need for a device that can split the wood quickly, safely, and ergonomically, without unnecessary movements or heavy physical strain.

Motivation for Development and Design Focus

The reason for the development is that existing log splitters are often bulky, inefficient, and physically demanding, leading to fatigue, time loss, and an increased risk of injury. By opting for a thoughtful design that focuses on ease of use, safety, and adaptability to various wood sizes, this log splitter addresses the specific needs of the user and the terrain on which it operates.

Objectives

Project Goal

This project aims to design a log splitter that enhances the wood processing process by reducing physical strain, improving the working position, and increasing processing capacity. The machine will be easy to operate during extended use and will be designed to meet the needs of agricultural settings, prioritizing robustness, portability, and safety.

Technical Specifications

The log splitter is designed to process logs with diameters ranging from 15 to 35 cm, splitting them into multiple pieces with a processing time of under 10 seconds. It will have a modular structure to facilitate maintenance and repairs, and it must comply with EU machine safety standards. The machine will be mobile, with a maximum size of 2.5 x 5 meters, to ensure it can be transported on public roads.

Performance and Durability

The log splitter will be powered by a hydraulic pump shown on figure 2, driven by a tractor's driveshaft, offering faster processing times and an isolated hydraulic system for improved reliability. A central control panel ensures easy operation. The machine will be coated for durability and able to operate in temperatures from -20°C to +50°C, with an emphasis on easy maintenance and safety.

Figure 2: Hydraulic pump [1]



The final design, shown on figure 5, is a mobile log splitter built for ergonomic use and practical deployment in the field. Thanks to its raised working height, logs can be positioned easily without heavy lifting or bending. A powerful linear hydraulic cylinder ensures controlled and efficient splitting. The machine is trailer-mountable and equipped with essential safety features, including a protective guard and brake lights. Its modular structure simplifies maintenance and allows easy adjustment for various log sizes.

Interactive Features

- 1. Scan the QR code to download the **Vuforia View** app
- 2. Open the app
- 3. Place the ThingMark on the icon left of the QR code and explore it in full scale using augmented reality.





Results

Log Splitting Process Analysis and Optimization

The design process began with an analysis of the existing log splitting process, identifying bottlenecks and exploring various technical solutions through functional decomposition and morphological analysis (figure 3), leading to key design improvements.



Initial Design Concept for the Wood Splitter The design process progressed with a first draft of the wood splitter,

offering a general visualization of its layout and functionality. This is shown on figure 4.



Figure 3: Morphological overview

Selected Design and Refinement

After evaluating the concepts, a driveshaft-driven system was chosen, featuring a height-adjustable stationary splitting wedge and a central control panel on the side. The design was refined with 3D CAD modeling, focusing on structural integrity, ergonomics, and ease of maintenance.

Method

Conclusion

Figure 5: Log Splitte

The developed design combines practical robustness with a clear focus on ergonomics and safety. By approaching the wood splitting process from the user's perspective rather than solely from the power source, a log splitter was developed that is practical for real-world use while significantly reducing physical strain. This approach demonstrates how engineering design principles can lead to more efficient and user-friendly solutions in agricultural mechanization.

References

[1] [Online]. Available: https://stock.adobe.com/be fr/search?k=hydraulic+pump.

Supervisors / Co-supervisors / Advisors: Prof. dr. ir. Daenen Michael, dr. ing. Bijnens John

Prof. dr. ir. Kellens Karel, Prof. dr. ir. Lievens Jeroen,





