

***3D Design Of A Physical Condition Detection Tool for Cocoa Fruit (Theobroma Cacao L.) Using SolidWorks Software***

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***ABSTRACT***

*Cocoa (Theobroma cacao L.) is an important plantation commodity for the Indonesian economy. Fruit quality at harvest greatly determines post-harvest bean quality, making the sorting process crucial in ensuring the quality of raw materials for the processing industry. Manual sorting methods have drawbacks including assessment variability, labor-intensive operations, and low throughput. This research aims to determine technical specifications and create a three-dimensional model (3D modelling) of the main components of a cocoa fruit physical condition detection tool, including the main frame, power transmission system, and servo actuator using SolidWorks 2021 software. The method used is a systematic and staged design-based approach, covering literature study, frame design, conveyor design, hopper design, system integration, design assembly, structural testing using Finite Element Analysis (FEA), and expert validation. The design produced a three-dimensional assembly model consisting of a 35mm × 35mm × 1.2mm galvanized hollow iron frame, a PVC belt conveyor system with 20T and 40T timing pulley transmission (2:1 ratio), a type 304 stainless steel hopper, a panel box, and a servo motor sorting mechanism. FEA structural testing showed a maximum Von Mises stress of 7.44 MPa, maximum displacement of 0.07 mm, and minimum Factor of Safety of 29.65, all of which meet machine structural safety standards. Validation by five expert respondents using a Likert scale questionnaire yielded a feasibility percentage of 87.2% in the Strongly Agree/Very Good category, indicating the design is feasible for further development toward the fabrication stage.*

***Key words:*** *cocoa, belt conveyor, 3D design, SolidWorks, Finite Element Analysis*