

Innovation in Product Design 3D Smart Panel

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Abstract— Technological developments are expected to help humans in quality of life. The industrial world is required to prepare for the industrial 4.0 revolution designed to integrate the online world with production lines in industrial processes. All production processes in era 4.0 are out and run with the internet as a supporting. Fusion 360 is a product by Autodesk that functions are to be able to integrate the fields of design and manufacturing for the industry into a single data center platform software system with to hopes the design devices, manufacturing processes, and IoT (Internet of Things). The suggested research is to create a 3D Smart Panel product design with 360 fusions used as a prototype of electrical short circuit protection. Specifically, the electrical protection device is designed to monitor and regulate electricity usage remotely via smartphone or the web so is expected to be able in to prevent accidents due the electrical

Keywords—Design of Experiments; Electrical Energy Systems; 3D; Smart Panel;

I. INTRODUCTION

Current technological developments are expected to help humans to improve quality of life. The industrial world is required to prepare for the industrial era 4.0 revolution designed to integrate the online world with production lines in industrial processes. All production processes in the era of the industrial revolution 4.0 are carried out and run with the internet as a support. Industry 4.0 is expected to be able to increase industrial productivity, as well as to be able to open up employment opportunities so that it is possible to open markets to cross countries. Also, with the support of industrial technology 4.0, the demand for workers' needs will be more specific and detailed.

The need for electrical energy continues to increase, causing the need for efforts to quickly find new technologies that produce electricity and their use. Most of the human life equipment support currently uses electricity for its operation. However, as its use increases, electrical energy will also be dangerous if its use is not equipped with a good

protection system, for example, to cut off electricity during overload. Conventional overload protection devices such as the MCB are only able to cut off all electricity to all loads and cannot break the specific load as required by the user for in order to keep the load fixed when overloaded. Protection system that can cut off the flow of electricity when repairing the excessive load of electricity in the house or building does not turn off completely and only turn off the load that is not prioritized. This can be overcome by using a Smart Panel that can cut off the electricity with a specific load that is not prioritized. The current Smart Panel requires many cables connect the Smart Panel to the load so it will be troublesome if you have to install the Smart Panel on a house or building that has used a conventional protection system.

The internet is a technology that allows several devices to be able to use cable or wireless. By using the internet each device can send data and send it to other devices. One use of the internet that is becoming a trend now is the internet of things (IoT), the Internet of Things (IoT) can combine with electrical or



electronic devices so that each device can provide requests to other devices without passing through cables. In addition to being able to connect between Internet of Things (IoT) devices, it is also possible to connect one device with a Smartphone or computer so that the device can be monitored and controlled remotely.

This study discusses the design characterization and work characteristic analysis of the Smart Panel Product model that can be used as an electrical short circuit protection tool. Smart Panel Product Models are designed and simplified using Autodesk Inventor Fusion 360 software. Simulations are carried out using variations in size and design so that it will be feasible to do mass fabrication.

II. RELATED RESEARCH STUDIES

Research published under the title "Autodesk Fusion360 Research and Application in Industrial Design" has been carried out and concluded as Fusion 360 is a perfect design platform that supports collaboration from cross-platform sharing through the cloud which allows for collaboration across regions, able to integrate design and manufacturing, rendering and analysis, collaborative management, and supporting more than 50 types of data formats, making this design platform ideal for small product development. Fusion 360 is also able to answer challenges in the design of devices that are installed in the communication between the design and manufacturing strategy of the device [1]. Further research with the title "Digital design and manufacturing in the cloud: Overview of software and services" can be concluded that all engineering design, engineering analysis, manufacturing, and production in all phases of the product development cycle can be carried out on software applications and services accessed through the cloud and the production phase can be done through digital design and manufacturing of software and services in cloud computing [2].

Research on "Design and Optimization of Geometric Characteristics of Helical Spring Using Fusion 360" has completed modeling and analysis of spring suspension using Autodesk Fusion 360 Software [3].

III. RESULT

The results of the whole process consist of Smart Panel products that can monitor and control electricity usage remotely via smartphone or the web.

- Analysis of the "Smart Panel" product design process parameters

This section will explain the steps in creating a Smart Panel product design from the beginning to the design details, and the results of the design are 3D models with parametric methods. Parametric-based modeling allows designers to incorporate original designs into model development. The word parametric means that the geometric of a design, such as dimensions, can vary at any time in the design process. Parametric modeling is done by identifying and creating the main features of the design with the help of computer software. Design variables, described in sketches as parametric relationships, can then be used quickly in modifying / updating designs.

In Autodesk Fusion 360, the parameter modeling process is determined as follows:

1. Make a rough two-dimensional sketch of the basic shapes of the basic design features
2. Apply/change boundaries and dimensions to a two-dimensional sketch.
3. Extrusion, swivel, or parametric two-dimensional sketch broom to create solid basic features of the design.
4. Add additional parametric features by identifying relation features and complete design
5. Analyze the computer model and refine the design as needed.
6. Create the desired image display to document the design.

The results of the product design activities are as follows:

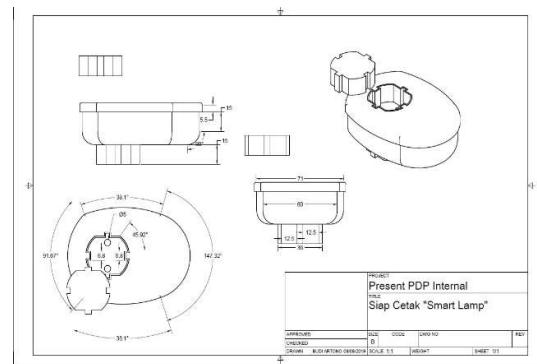


Figure 1. Product design results

- Results of analysis of product performance simulations

This section presents an analysis using the Finite Element Analysis method found in Fusion360. This analysis is carried out to see the performance of the Smart Panel where if the product is given heat due to the effect of the flow of electric current on the product

by trying materials using PLA and ABS (plastic-type material), it will appear the process of heat transfer and the spread of heat energy which can later be used as a reference to test the basic material that is suitable and suitable for making materials Smart Panel. This study was conducted to determine the displacement, heat and other effects that arise and result from static products which are also mechanically modeled by parts.

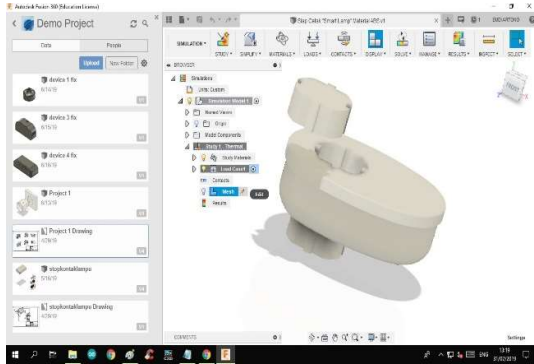


Figure 2. Product design results

In Autodesk Fusion 360 the process of thermal analysis of static stresses and also with mechanical support is done with the Fourier equation which allows to determine heat flux and conduction based on knowledge of temperature distribution in a particular material medium. Transfer Changes in heat here is the process of increasing and decreasing the temperature so that it can determine the thermal conductivity of a product.

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right)$$

In the product analysis process, the process is applied Radiation which is carried out the thermal energy transfer analysis process as the effect of the presence of electromagnetic waves.

$$Q = \sigma \epsilon A (T_s^4 - T^4)$$

The process carried out at Autodesk Fusion 360 uses a simulation study with Thermal Stress.

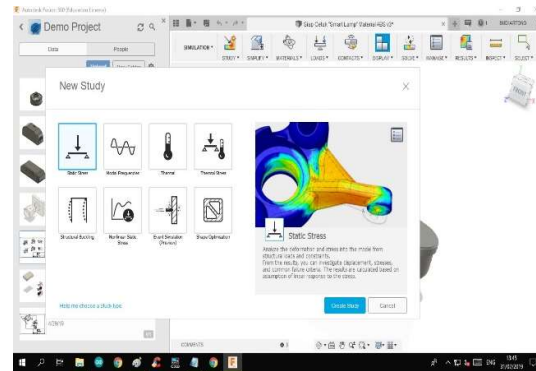


Figure 3. Simulation with Thermal Stress

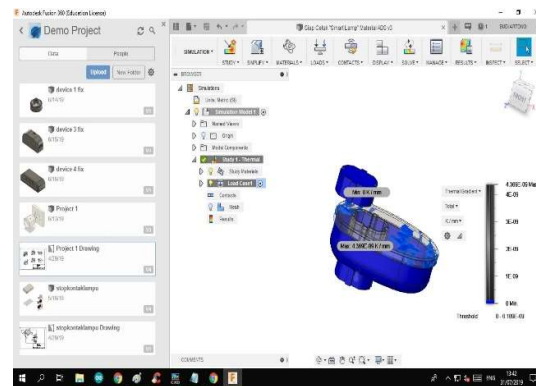


Figure 4. Thermal Stress Analysis of products

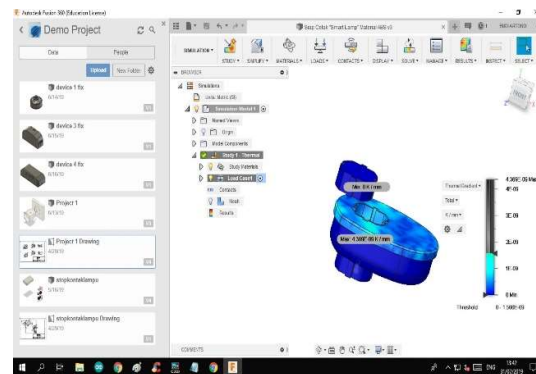


Figure 5. Thermal Radiation Process

The machine used to manufacture products is a 3D printer. The method used is development research so that it will produce a prototype product that will be mass-produced. This prototype will greatly help determine the next production process and the investment value that must be spent to make a product. One of the advantages of using a 3D printer for the process of making this prototype is that it can

make prototypes in a short time and low cost for making conventional prototypes.

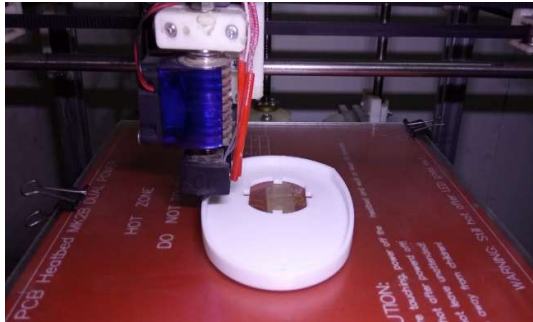


Figure 6. 3D Printing

The product has been made with a 3D printer machine that has gone through the Numerical Study and Characteristics Test so that it can be implemented and developed to be used as a protection device for electrical short circuit.



Figure 7. Results from 3D Printing



Figure 8. The results of making smart panel products

IV. CONCLUSION

The results of the Numerical Study and Characteristics Test in the 3D Design "Smart panel" show that material selection and analysis are theoretically mostly similar to analytic methods. Thus, results can be used and products can be implemented. The product developed can be used as a protection device for electrical short circuit.

V. REFERENCES

- P Song, P & M Qi, Y & C Cai, D. (2018). Paper-Open Access "Research and Application of Autodesk Fusion360 in Industrial Design". IOP Conference Series: Materials Science and Engineering, 359, 012037. doi: 10.1088/1757-899X/359/1/012037.
- Dazhong Wu, Janis Terpenney, And Dirk Schaefer. (2017). "Digital design and manufacturing on the cloud: A review of software and services". Artificial Intelligence for Engineering Design, Analysis and Manufacturing, 31, 104–118. doi:10.1017/S0890060416000305
- T.Tirumala Sandeep, K.Mani bhushan, A.Lalith sai kumar, P.Satish kumar and A.Sai ram Prasad, "Design and Optimization of Geometrical Characteristics of Helical Spring Using Fusion 360", International Journal of Mechanical Engineering and Technology, 9(5), 2018, pp. 594–602. <http://www.iaeme.com/IJMET/issues.asp?JType=IJMET&VType=9&IType=5>
- Autodesk360. Autodesk 360 overview. Accessed at <https://360.autodesk.com/Login>
- Autodesk360. Autodesk features. Accessed at <http://www.autodesk.com/products/fusion-360/features>
- Fusion360. Autodesk Gallery. Accessed at <https://gallery.autodesk.com/fusion360/projects/pursuit-bicycle-concept>
- <https://www.norwegiancreations.com/2016/07/basic-static-stress-simulation-in-fusion-360/>
- Autodesk FUSION 360: Static Stress Analysis of a Mechanical Support
- Autodesk FUSION 360: Simulation for Fusion 360