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Stick Versatile Design for Human Disabilities

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Abstract: Every human being must have the need to run their daily life but unlike the people with special needs. They require special auxiliary equipment in order to run their lives. These tools can be a stick for support when walking. The problem solving for good design should pay attention to human factors and activities such as size, shape, position in activity, behavior and habits of human activity in order to reach the productivity of labor. Sticks are made must be ergonomically designed, so, it is more efficient. Stick product is also equipped with braces body and GPS systems to provide comfort for its users.

Key words: Stick versatile design, GPS systems, ergonomics, disable, equipped, equipment

INTRODUCTION

Human in their life use a lot of design as a supporting facility activities. Human want are in accordance with the product design trends and accommodate his needs are increasing. Given the current state, the trend of product design that is changing due to the increase in human needs raises human awareness of the importance of exclusive and representative design, increasing efforts in the field of design resulting in quality design competition, increased marketing factors (attractiveness and selling power in the market) as well as increasing production capacity demands. In addition, product design activities that produce creative ideas are also, influenced by the speed of reading the situation, especially, the needs of the market and consumer demand.

Ergonomics or ergonomics (in English) is a word derived from Greece is ergo meaning research and nomos which means law (Wignjosoebroto, 2006). Intent and purpose of the ergonomics discipline is to acquire a complete knowledge of the problems of human interaction with technology and its products, so as to enable an optimal human (technology) system design.

Human disfabel or disabilities are humans who have limitations in activity and participation restrictions. The limitation was caused by a a functional problem members or parts of the body to function normally. Human disfabel always need the help of the equipment in order to perform daily activities normally. Human disfabel will necessarily require auxiliary equipment in accordance with needs are tools used to assist the limitations in performing activities.

Human limitations in their activities, especially in the motion when walking, then needed a walker. Each walker has function lawyer vandalism and the use of different ways. There are several factors that considered to determine the use of a walker among others, the ability of patients to proceed with one/both feet, balance patient with one foot/both feet and maintaining the body in a standing position. As for some of the types of tools walker including crutches, walkers, wheelchairs, tripod/quadripod and stick (baton).

One of the most commonly used walker or road aids is the type of crutches because this type is able to hold the weight of the body in a balanced way and can train the leg muscles to keep the stretch. Basically crutches are divided into two namely axilla crutches and nonaxilla crutches. Nonaxilla crutches can transfer 40-50% of body weight while axilla crutches can transfer up to 80% weight. This makes the axilla crutch better in sustaining the weight of the material, so the axilla crutch is more widely used by humans who have special needs in performing their daily activities (Ghina, 2013; Bojan *et al*., 2014).

The design of this stick product is done, so that, everyone who uses the stick can be more comfortable to use. Sticks used can be used as walkers and seating, so that, when people are tired of walking then they do not need to bother looking for a seat but with his own cane they can sit anywhere. This stick is also there is a GPS system that allows for others to mengatahui the person is there which makes it easier if there is something that is not desired. GPS consists of a constellation of satellites orbiting around the Earth. Every satellite has an atomic clock on its board, so, know the time. Because it orbits around the earth, each satellite continues to transmit its location at 1.575 GHz. With the help of a GPS receiver pointing to the sky, we can listen to this transmission. When listening for 3 or more satellite transmissions, we can do triangulation of location on earth If the fourth satellite is available, we can even get the height (Radhika *et al*., 2016; Sanders and McCormick, 1993; Ginting, 2010).

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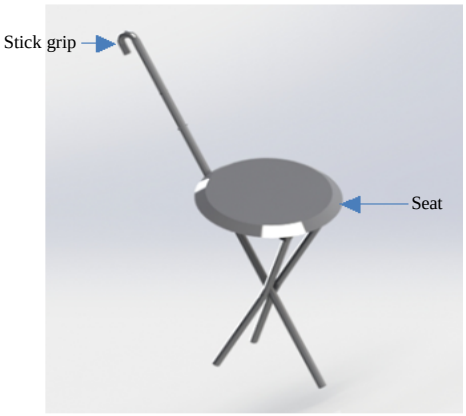

Fig. 1: Versatile stick (SolidWork in 2018)

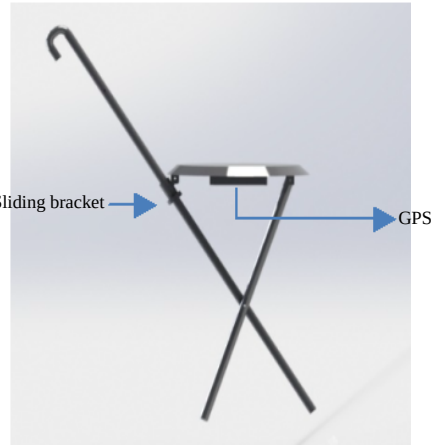

Fig. 2: Versatile stick (SolidWork in 2018)

Product design: This versatile stick has three functions that can facilitate the special needs of every human being. First, stick can be used to help humans disfabel walk, so, they can live everyday life like any other normal human being.. Then when we pushed down part of the holder, then stick can be used as a chair, so that, when users tired to walk due to support the body, they do not need to seek a seat in advance, so, it's easier to be able to sit anywhere. Lastly, the stick also has a GPS device that can help people find or control the disfabel human existence and in the event of unwanted things, other people can easily to find the location.

The design of this versatile stick is intended for people who have the height is 150-190 cm. In designing these selected material Stainless Steel 201 Anel because it possesses a light and strong material. Versatile rod design using Software SolidWork like Fig. 1-5.

Fig. 3: Versatile stick (SolidWork in 2018)

Fig. 4: Versatile stick (SolidWork in 2018)

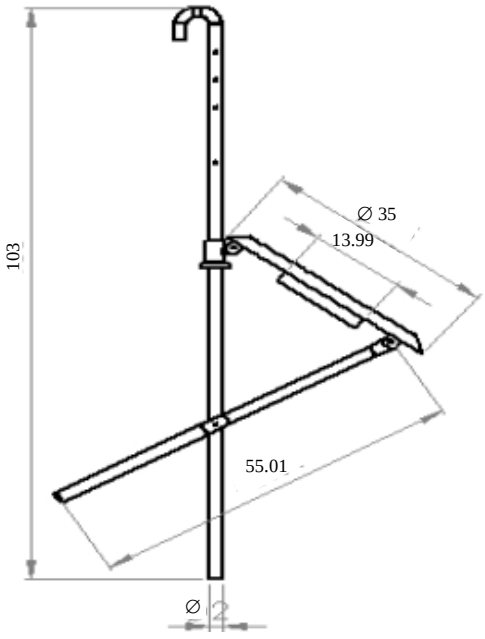

Fig. 5: Size of versatile stick (SolidWork in 2018)

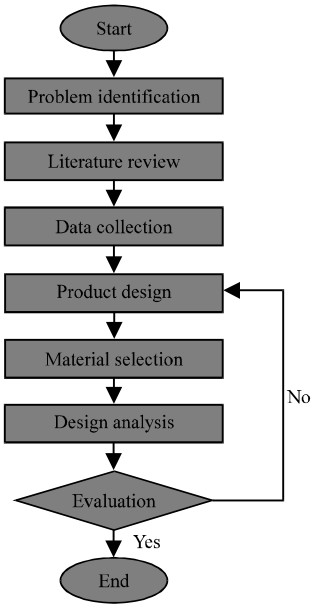

Fig. 6: Research flow chart

MATERIALS AND METHODS

This research workmanship step as illustrated in the following research methodology. The research methodology is a step or sequence and used as a researcher in conducting research.

Figure 6 is a flow chart of this research workmanship. The first step to do is to identify and formulate the problem. In this case the problem problem is the lack of ergonomics stick or crutches in humans disfable (disabled) that only has one function. Then do the design and product development for the solution product of the versatile stick in humans disfabel (defect). The data needed in the design of this stick product is the data of normal adult human anthropometry. Furthermore, data measurement and product design is done with the selection of stick material by using SolidWork. Then tested and viewed the test results whether the stick is feasible and safe to use.

RESULTS AND DISCUSSION

Versatile stick for analysis using SolidWork analysis. Analysis versatile stick when given load of 150 kg as described.

Stress analysis (von Mises): Voltage is set force (force) on an object surface. The narrower area of the surface but the style remains, the greater the stress. The voltage is indicated on the red shades, the smallest is the most

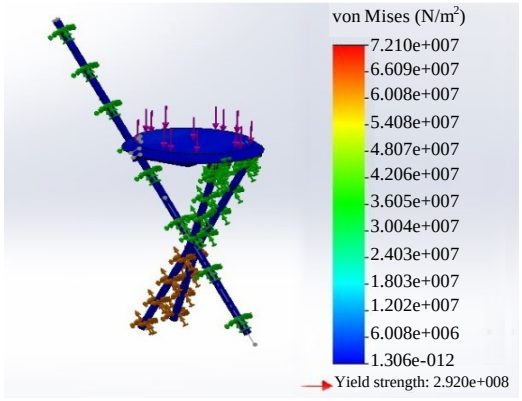

Fig. 7: Results analysis tension (SolidWork in 2018)

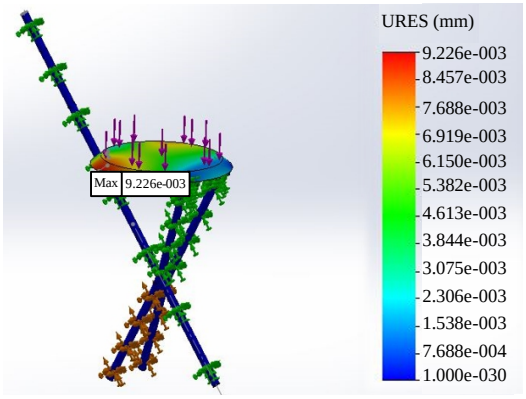

Fig. 8: Results analysis displacement (SolidWork in 2018)

blue. While the area is an area with medium voltage yellow-green-blue color (Fig. 7). Based on the above simulation results, versatile stick declared safe because there are no red gradation.

Analysis changes shape (displacement): Displacement is the change in shape on the body is subjected to force. The part that suffered the greatest displacement of this framework is the most red-colored area and the parts that have the smallest displacement is the most blue. Displacement simulation results can be seen in the Fig. 8. Based on the simulation results above, the greatest displacement value is on the red part of 0.009226 mm.

Safety factor (factor of safety): The safety factor is the main criterion used in determining the quality of a product. Benchmark if the minimum FOS value is <1, the product quality is bad, it is not safe for consumption is likely to endanger, otherwise if the FOS value of more than one (usually between 1-3) then the product of good

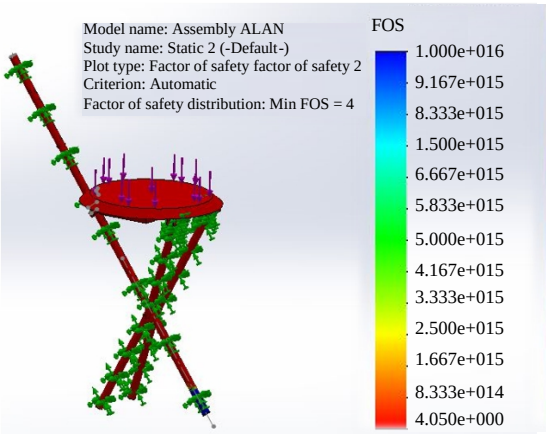

Fig. 9: Results analysis safety factor (SolidWork in 2018)

quality, safe and suitable for consumption. However, if the value of the minimum FOS reach 3 digits or more (e.g., 100 or more) then the product is safe, of good quality but the price is very expensive and tend to weigh large because the material used is too much (Fig. 9). In the above simulation, the smallest FOS value is 4 so, it can be declared safe.

For how GPS signals are transmitted by satellite to the GPS will be used to calculate the travel time (travel time). This travel time is also called the Time of Arrival (TOA). In accordance with the principles of physics that in order to measure the distance can be obtained from the time multiplied by the propagation of the signal. Thus, the distance between the GPS satellites can also, be obtained from the Physics principles. Each signal transmitted by the satellites will also, contain very detailed information such as the satellite orbits, time and obstacles in the atmosphere. Satellites use an atomic clock that is the most precise time unit. To be able to determine the position of a GPS in two dimensions (distance), it takes a minimum of three satellites. Four satellites will be needed in order to obtain location, altitude (in three dimensions). Each satellite will emit a signal to be received by the GPS receiver. These signals will be needed to calculate the distance from each satellite to the GPS. From that distance will be obtained radius range of each satellite. Through a fairly complex mathematical calculations, the intersection (intersection) of each circle had satellite coverage will be used to determine the location of the GPS on the surface of the Earth. Intersection (intersection) of each circle had satellite coverage will be used to determine the location of the GPS on the surface of the Earth.

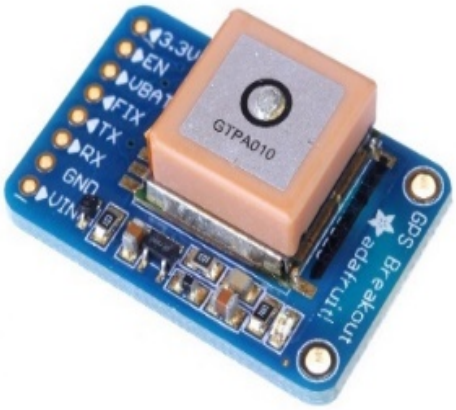

Fig. 10: GPS module (commons.wikimedia.org, 2018)

Concept of this design emphasizes some aspects, one aspect of function and design. By changing the form of a stick and a GPS system then adds the aspect function. It aims to facilitate and provide comfort to the user. Aspects of the prices are very emphasized in the design of this tool. It is expected that the design of this product can make these products can be more affordable, so, it can be accepted in society by not spending much money (Fig. 10).

CONCLUSION

In this study, presents the design and development of innovative products stick versatile intended to provide comfort to people with special needs. These sticks can be used as a walking aid as well as seating. This versatile stick equipped with a GPS system that is useful to know the whereabouts of the user. This product is intended to men who have a height of 150-190 cm and declared safe for humans who have loads up to 150 kg.

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