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AVOID FORGETTING TO PRESS THE LEFT SIGN BUT TURN RIGHT WITH SMART LIGHT-TURN SIGNAL (SLTS)

Lamto Widodo[1*], Lina Gozali[2], Cherry Atmodjo[3]

[1] Industrial Engineering Department, Universitas Tarumanagara, Jakarta, Indonesia*
Email: lamtow@ft.untar.ac.id
[2] Industrial Engineering Department, Universitas Tarumanagara, Jakarta, Indonesia
Email: linag@ft.untar.ac.id
[3] Industrial Engineering Department, Universitas Tarumanagara, Jakarta, Indonesia
Email: cherry.545190059@stu.untar.ac.id

*Corresponding Author

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ABSTRACT

Turn signal lights function to give a signal when a motorcyclist wants to turn right and left or when overtaking other motorists. By turning on one side of the light, right or left, it gives information to the riders behind and in front that you want to turn. Some of the factors that cause drivers to forget to turn off the turn signal are a lack of concentration and the color of the turn signal indicator during the day is less visible. Turn signal lights that stay on cause confusion for other motorists. Confusion of other drivers can break the concentration of road users and cause traffic accidents. The method used in this study is the distribution of questionnaires and design based on the Analytical Hierarchy Process. The "Smart Light Turn Signal –SLTS"Mirror design consists of 4 alternative variants. The chosen alternative is the fourth alternative. The selected product is then prototyped and implemented on the user's motorcycle. As a result, most users no longer forget to turn off the turn signal.

Keywords: *design, sein lamp, SLTS*

1. INTRODUCTION

Transportation is one of the basic needs for humans. The needs of daily life can be met by moving from one place to another by means of transportation. Various means of transportation were developed to facilitate and shorten travel time. One of the most widely used means is the use of motorbikes, which have flexible characteristics for various terrains and usage purposes. With this ability, motorbikes really help with daily activities, including for work, shopping, going to school, and other needs. Such is the importance of the role of motorbikes, almost every house has a motorbike.

Based on data from the Ministry of Transportation of the Republic of Indonesia, the number of motorized vehicles in Indonesia will reach 141.99 million units in 2021. This number has increased by 4.30% from the previous year of 136.14 million units. This number has been steadily increasing in the last five years. The highest increase in motorized vehicles occurred in 2018, with an increase of 6.38%. In detail, the most dominant as many as 120.04 million motorized vehicles are motorcycles or around 84.56%. A total of 16.41 million vehicles were private cars. Then, there are 5.30 million truck-type vehicles. Meanwhile, the number of buses operating within the country is only 237,566 units. Of the four motorized vehicles, motorbikes have the highest growth every year. The highest increase in the number of motorcycles was 6.44% in 2018. [1]. While the highest distribution of motorcycle ownership is in Central Java, East Java, the capital city of Jakarta and West Java. [2]

The large number of vehicles on the road causes the potential and work safety risks to increase for the drivers. Motorcyclists are no exception, who make up the largest population on the road. To ensure the safety of motorcycle riders, it is equipped with various safety features, including brakes (front and rear), mirrors (right and left), lights (front), brake lights (rear), turn signals (right left front and rear) and others specifically added. Every driver must check all safety features in good working condition, before traveling. This research focuses on the design of ergonomic turn signals. There are several turn signal functions that motorists must know. Here are three other functions of the turn signal, namely; (1) as a sign of changing lanes, (2) as a sign of overtaking the vehicle in front and (3) as information for vehicles in the opposite direction. [3]. When driving through streets that have two or more lanes, it is important to turn on the turn signal when changing lanes. That way, other motorists who are in the same lane from the opposite direction can anticipate, because they have been given a turn signal code. They can also reduce speed and cancel their intention if they are going to overtake the motorbike. In driving, sometimes we have to maneuver to overtake other vehicles in front of it. So that other drivers know that we want to overtake, the turn signal must be activated. With a signal from the turn signal, the driver in front can understand the maneuver that will be carried out soon.

Preliminary studies of this research show that there is negligence in the use of turn signals, namely drivers turning on the lights when they want to turn/overtake, but forget to return to the neutral position after the overtaking and turning activities are complete. This situation greatly disturbs other vehicle users both in the same direction and in the opposite direction, for roads with 2 (two) lane directions. This condition is more common during the day than at night. The problem that users complain about is that when the turning activity is finished, the turn signal indicator lights up on the dashboard/speedometer and is not clearly visible. This is because the color of the lamp lacks contrast to sunlight. Based on the above problems, this research is aimed at designing motor turn signal accessories that can help drivers see the motor turn signals that are still on, without looking at the speedometer. This design is necessary to reduce driver negligence/forgetfulness, so that it will not endanger themselves and other drivers. This design is based on the principles of work ergonomics as well as the wishes and complaints of the users.

The word ergonomics comes from the Greek: ergos (work) and nomos (law). The terms ergonomics and human factors are often used interchangeably (for example, human factors/ergonomics – HFE or EHF) practices adopted by the IEA. The adopted definition of ergonomics (or human factors) is the discipline concerned with understanding the interactions between humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance . [4]. Ergonomics is the science that studies the interactions between humans and machines and the factors that influence these interactions. The goal is to improve system performance by increasing human-machine interaction. This can be done by better interface 'design-in' or by 'design-out' factors in the work environment, in tasks or in work organization that degrade human-machine performance). Anthropometry is a field that studies the size or calibration of the human body. Anthropometric data are used in ergonomics to determine the physical dimensions of workspaces, equipment, furniture, and clothing to ensure that physical discrepancies between equipment and product dimensions and the corresponding user dimensions are avoided [5]. Data on the size of all human limbs from certain ethnic groups is presented in percentage form. Therefore in anthropometry there are two ways of measurement, namely; (a) Measurement of the dimensions of the body structure (structural body dimension), and (b) Measurement of functional dimensions (functional body dimension) Measurements are made of the position of the body when performing certain movements.

Product design and development is a collection of structured and structured activities. Product design and development can also be interpreted as an arrangement of steps in which a company seeks to develop, design, and commercialize a product. Usually, the process of designing and developing a new product has 6 stages that must be carried out. [6]. The economic success of a manufacturing company depends on the ability to identify customer needs. Then by precisely creating a product that can meet those needs at a low cost. Design and development for products is carried out in a structured and structured manner. There are 6 stages in designing a new product, namely; (a) Phase 0: Planning, (b) Phase 1: Concept Development, (c) Phase 2: System Tier Design, (d) Phase 3: Detailed Design, (e) Phase 4: Testing and Repair, and (f) Phase 5: Product Launch.

The AHP method was originally developed to solve complex problems where there is very little data and statistical information on the problems encountered [7]. The AHP method is a form of decision-making method with multiple criteria. This measurement method is used to determine the ratio scale of discrete and continuous pairwise comparisons, which are obtained from actual or preference sizes. The AHP method makes decisions involving a number of criteria and. The alternative chosen is based on consideration of all related criteria

2. RESEARCH METHOD

The research began with problem identification, identification among motorcyclists who sometimes had difficulty seeing turn signals that were still on during the day. As a result, the driver forgets that the lights are still on even though they are not making turns, so that it will confuse other motorists. Based on this identification, the research topic was determined, namely the Design of Motorcycle Accessories to Improve Driving Safety, especially the design of motor turn signals to reduce traffic accidents. The next stage is literature study and field study as material for consideration for design. The core stage of this research is to design motorcycle accessories using Autodesk Fusion 360 software using Indonesian anthropometric data in general for the dimensions of work tools so as to reduce human error. This accessory is added to a sponge that has been (modified) by adding an additional turn signal with a direction towards the rider. The results of the selected design are then realized in a real form (prototype) by making holes in the motorbike rearview mirror first, then after that the LED lights can be installed. can be lit simultaneously in 2 (two directions). The final stage is the implementation of this tool and a survey about user perceptions to get feedback from users before and after using these motorcycle accessories.

3. RESULTS AND DISCUSSIONS

The following is primary data collected including data collection tools and respondent profiles, gender and age of respondents, as well as shared perceptions of turn signal lights in the research presented in Table 1, as well as Figures 1 to Figure 9.

Table 1. Results of Primary Data Collection

Type of Data	Number of Primary Data
Data collection tool	107 questionnaires (respondent data along

	with questions about product interests)
Respondents	Respondents 107 people (62 men and 45 women)

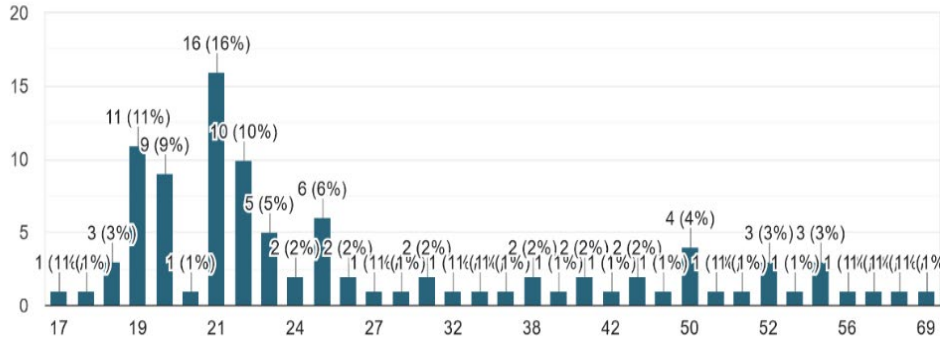


Figure 1. Pie Chart of Age Of Respondents

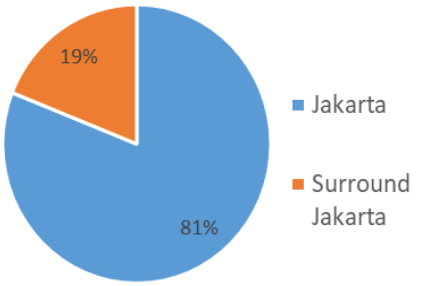


Figure 2. Residence of respondents

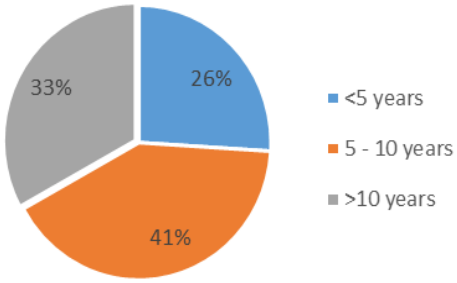


Figure 3. Driving Experience (years)

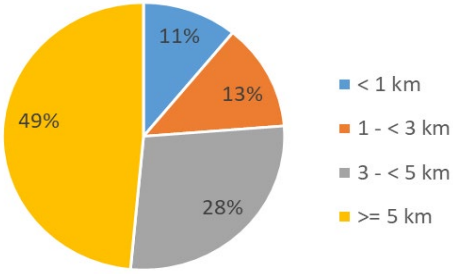


Figure 4. Distance of Respondents Riding a Motorcycle Everyday

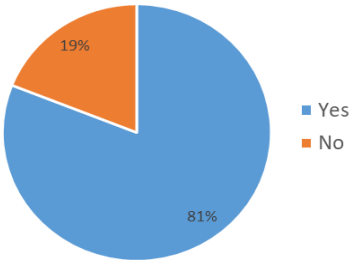


Figure 5. Respondents' habit of using turn signals before turning

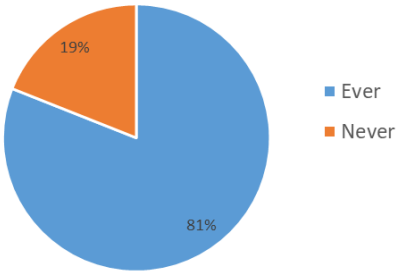


Figure 6. Respondents Experience Forgot to Turn Off Turn Signal Lights

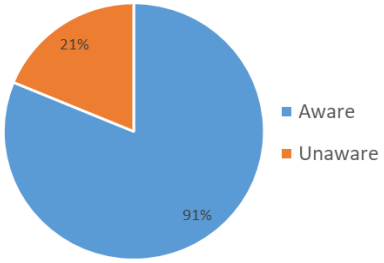


Figure 7. Respondents' Awareness of the Dangers of Not Turning Off the Sein Lights

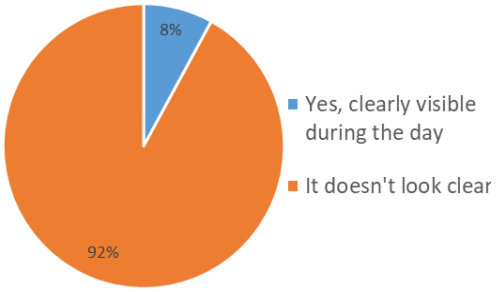


Figure 8. Respondents' opinion is that when the turn signal is on, it can be seen by motorists during the day

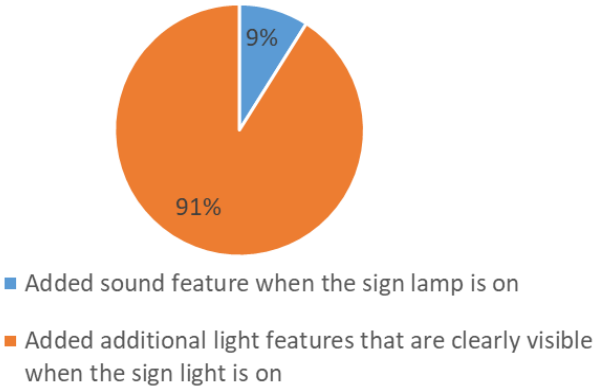


Figure 9. Respondents' Suggestions regarding Turn Signal Signal Improvements

The following are the results of a questionnaire regarding the level of importance of the existing aspects. A total of 85 respondents were asked to provide a scale from one to five, where the number one represents that according to consumers this aspect is very unimportant and the number five represents that according to consumers this aspect is very important to consider in this product. Identification of respondents' needs can be seen in Table 1 below.

Table 1. Identification of responden’s needs

No	Need matric	Number of respondents for each scale of need				
		1	2	3	4	5

1.	The degree of importance of durability to the product	0	0	3	24	58
2.	The degree of convenience importance to the product	0	0	2	28	55
3.	The degree of aesthetic importance to the product	0	3	15	22	45
4.	The degree of safety importance to the product	0	0	2	23	60
5.	The degree of ease of use is important to the product	0	0	5	26	54
6.	The degree of importance of the innovation to the product	0	0	4	30	51

Next, do the calculation of the Analysis Hierarchy Process (AHP) with pairwise comparisons between the variables in the rows and columns of the matrix. Comparisons were made by looking at the Saaty scale, after which normalization was carried out to obtain eigen value calculations and priority weights for each variable. Calculations using the AHP method can be seen in Table 2 and Table 3.

Table 2. Pairwise Comparison

	SC	**CV**	**AD**	**ED**	**EU**	**IN**
SC	1	3	7	7	9	9
CV	0,333	1	5	5	7	9
AD	0,144	0,200	1	3	5	5
ED	0,143	0,200	0,333	1	3	5
EU	0,111	0,143	0,200	0,333	1	5
IN	0,111	0,111	0,200	0,200	0,333	1
Total	1,841	4,653	13,733	16,533	25,333	32

SC: Security CV: Convenience AD : Aesthetics/design
ED : Durability EU : Ease of Use IN: Innovation

Table 3. Normalization calculation

	SC	**CV**	**AD**	**ED**	**EU**	**IN**	**Total**	**Mean**
SC	0,540	0,640	0,509	0,421	0,354	0,278	2,742	0,45
CV	0,180	0,214	0,363	0,301	0,275	0,278	1,611	0,258
AD	0,074	0,040	0,071	0,180	0,195	0,154	0,714	0,117
ED	0,074	0,040	0,023	0,059	0,117	0,154	0,467	0,075
EU	0,059	0,030	0,014	0,018	0,038	0,093	0,252	0,040
IN	0,059	0,023	0,014	0,011	0,012	0,030	0,149	0,023

Total	1,000	1,000	1,000	1,000	1,000	1,000	6,000	1,000

The design of the 'Smart Light Turn Signal' produces several product concepts that will be chosen by the public in the form of questionnaire respondents to determine which concept best represents consumer needs. In designing this SLTS product there are three concepts that have been planned, namely:

Table 3. Product Development Design Concept

3D Drawing Design	Explanation
Concept 1 	A red LED light is attached to the outer end of each mirror, the light used is an arrow-shaped LED light.
Concept 2 	The red LED lights are also attached to the outer ends of each mirror, and the LED lights are round.
Concept 3 	The installation of red LED lights is placed around the side of the motorbike rearview mirror.
Concept 4 	The installation of red LED lights is also still attached to the inner end of the rearview mirror of each rearview mirror like the first concept.

Note: this light will light up at the same time as the sign light is on so that the driver can see more clearly that the sign light for the motorbike is still on.

After determining the 4 design concepts, then the concept selection process is carried out. It takes a reference to assess the concept. The following is a Figure from the reference table, which is used to assess the concept.

Table 4. Selection of Concepts

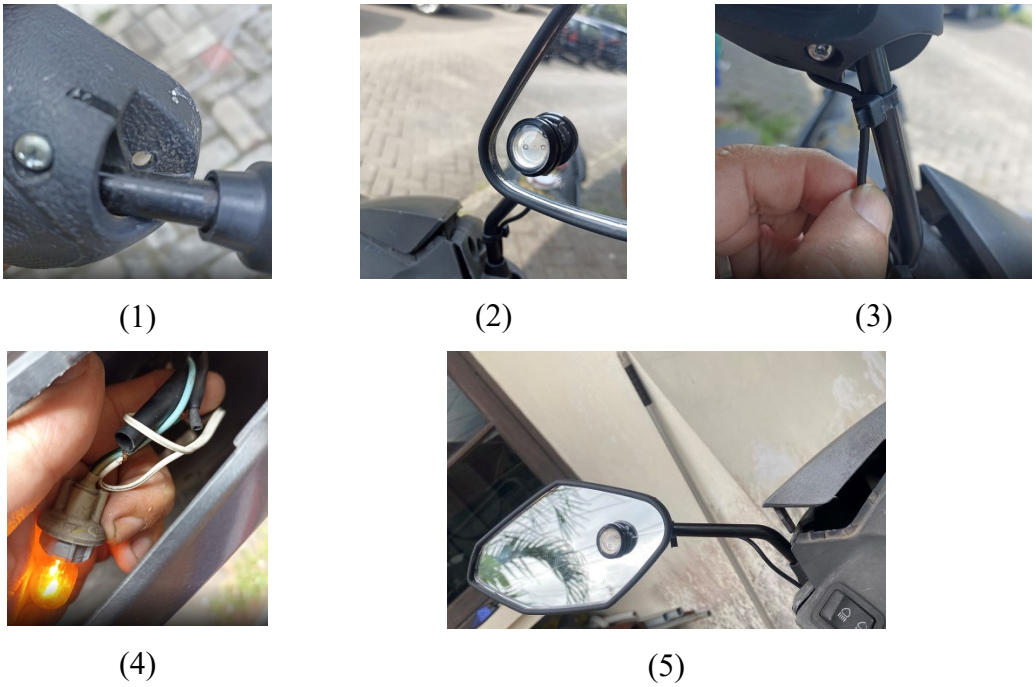
	Concepts

	Concept 1	Concept 2	Concept 3	Concept 4
Security	+	+	+	+
Convenience	0	0	0	+
Aestetic/Design	0	-	-	+
Durability	0	0	0	0
Easy to Use	+	+	+	+
Innovation	0	-	+	+
Sum of +	2	1	3	5
Sum of 0	4	3	2	1
Sum of -	1	2	2	0
Final Score	1	-1	0	4
Rank	3	1	2	4
Continue?	No	No	No	**Yes**

Finally, concept 4 was selected and then a prototype was made for implementation.

Implementation Results

Figure 10 presents the steps of assembling the 'Smart Light Turn Signal' product.



(1) (2) (3)

(4) (5)

Figure 10. The stage of installing the SLTS

The final stage is a questionnaire about the perceptions of 15 (fifteen) respondents after using a motorbike equipped with an SLTS, which can be seen in Figure 11. The question posed is, do you still forget to turn off the sign light after using the SLTS?

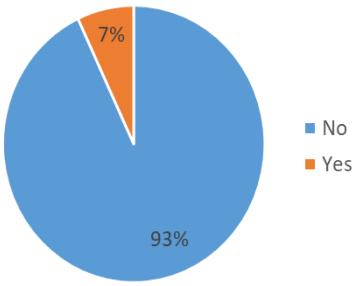


Figure 11. Experience of respondents in using the product.

Based on Figure 11, it can be concluded that as many as 93.3% of respondents no longer forget to turn off the motorbike turn signal after using the "Smart Light Turn Signal" product.

4. CONCLUSIONS AND SUGGESTIONS

The conclusions from the results of the design and development of the 'Smart Light Turn Signal' product as a motorcycle accessory are as follows:

1. Respondents who are motorbike riders mostly forget to turn off their turn signals after turning activities that occur during the day.
2. Developed 4 (four) SLTS concepts by considering the aspects of comfort in use, aesthetics, product durability, ease of use and innovation. Of the four concepts, concept 4 was selected as the best concept which was then transformed into a prototype.
3. From the results of product implementation, it can be concluded that the difference in driver negligence after using this product by 15 respondents was 6.7%, so it can be concluded that this design can be used and functions properly.

ACKNOWLEDGEMENT

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