Anti-drowsiness Helmet Using Heartbeat Sensor and Thermoelectric Cooler to Help Reduce Accident Rate

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Abstract. The high number of traffic accident cases in Indonesia is very alarming. This is caused by various factors, namely, the condition of vehicles that are not worth using, lack of driver alertness, traffic light violations, and sleepy drivers. According to Minister of Transportation Budi Karya Sumadi, some of the dominant factors collected in Lebaran 2017 National Transportation Posts stated that the human factor contributed 61% of road accidents, the remaining 30% were environmental and environmental factors, and 9% were due to vehicle factors. Figures 61% that includes negligent, less proficient use of vehicles and drowsiness. Safe helmet, is a tight helmet, closed so that the driver sometimes feel sultry when driving, causing the driver in a hurry to get to the destination. The purpose of this program are: 1) to understand how to design anti-drowsy helmet that can prevent the rampant accident cases caused by sleepy driver; (2) understand how helmet works, and (3) know the superiority of our helmet product compared with other helmets so that the ultimate goal of making this helmet can be useful for society and able to give solution to accident problem especially accident on motorcycle. Due to the problem, we provide anti-drowsy helmet solution which is equipped with Themoelectric cooler to make the driver more comfortable driving. The results of this program is the creation of cold and anti-drowsy helmets as a solution to reduce the number of traffic accidents, especially accidents caused by drowsy motorcycle drivers, works 100% according to its function.

1. Introduction

Rest is a basic requirement of every human being because by resting, humans can come back fresh and fit. Rest is not only done with sleep, but can be done with other activities so that a person's physical condition can stay healthy and ready to move back, one of which is relaxation. The process of restoring one's stamina is diverse, some only take a short time to be able to refresh the body, but there is also a need of sleep, so that their bodies really fit. Although in a drowsy state, people generally force themselves to come home after work without resting for a while. In addition to endangering yourself, driving in a sleepy condition is certainly dangerous for others. Such factors can be included in human negligence. In addition, driving negligence may also be in the absence of appropriate equipment. One of them is the use of helmets that are not SNI (Indonesian National Standard), so the helmet is easily dislodged, broken, and not suitable for driving. A safe helmet can be a tight and tight helmet in accordance with the user's head size. So there are riders who are reluctant to use a helmet because of heat and uncomfortable to wear.
According to the Central Bureau of Statistics (BPS) data, in 2015 the number of traffic accidents reached 98.9 thousand cases. This figure increased 3.19 percent when compared with the previous year which reached 95.5 thousand cases. The number of traffic accidents in the last 10 years fluctuated (Polisi Republik Indonesia, 2013), the highest increase in 2011 which reached 108 thousand cases. Whereas in 2010 only 66.5 thousand cases occurred. While the most cases occur in 2012 with 117.9 thousand cases. Therefore, a cooled helmet is made for the purpose of providing driver comfort when driving, so that in hot air conditions the driver remains calm and unhurried. This helmet is also equipped with a pulse sensor that has been programmed and connected with the buzzer, so that when the pulse of the rider under 70 bpm buzzer will sound as a warning alarm [9]. As Reported by Lembaga Ilmu Pengetahuan Indonesia (LIPI) in 2012, cooled helmets have been created previously by Nara Pradana, who uses sodium polycrilate as a cooling helmet, but we think it is less efficient because it requires a water injection in it. So we took the initiative to create a more simple helmet that has a temperature sensor connected to the peltier [6] to cool the helmet.

2. Method of Implementation

Implementation of this program is carried out for 3 months to produce comfortable anti-drowsy helmet. In the process of making it done in the State University of Yogyakarta, especially in the Faculty of Engineering UNY. The method used in this program is Waterfall method [5], which consists of analysis, design, development, testing, and application. Anti-drowsy helmet has been made with arduino uno, thermoelectric cooler, buzzer, and pulse sensor.

Analysis. Analyzing is done to determine the extent of the problems that occur and able to determine the right solution to the problems that exist. The problem here lies in the high number of accidents that one of the factors caused by the driver is sleepy. So determined the exact solution of the problem that is made anti-drowsy helmet.

Based on the results of the analysis, it was concluded that when in hot weather, drivers tend to drive vehicles in a hurry and precede each other. One tool that is able to provide comfort for an effective and efficient rider is a thermoelectric cooler. At this stage also carried out the analysis of the pulse of an insider normal and drowsy circumstances. And also conducted an analysis of the accuracy of pulse sensor and temperature measurement on peltier when turned on.

Designing. At the design stage made the design, then from the design is made the design of physical form. The most important component is the arduino because it has loaded programs that can help the performance of the tool, so that almost all components are connected to the arduino [1]. Here is the design of cooled and anti sleeping helmet:
Development. Development stage is by developing tools into products that can be used and beneficial to the community. Helmet in general only serves to protect the head only, so the helmet was developed to have a cooling system and anti drowsiness function. The cooled helmet function is supported by a series of peltier components, headsinks, and small fans [7] Meanwhile, the function of anti-drowsy helmet is supported by a series of pulse sensor components and buzzers.

Testing. Tools that have been created are tested to work properly. Especially a trial of the pulse sensor. As well as battery life used. Tools are tested to work optimally.

Implementation. The last stage is the implementation, which is a tool that has been tested and proven to perform well in accordance with the expected output targets, then the tool can be applied to the community, so the benefits can be immediately felt.

3. Result and Discussion

The results obtained in the manufacture of anti-drowsy helmets are: can know the use of anti-drowsy helmets, know how to design and process anti-drowsy helmets, and know the benefits of anti-drowsy helmets compared to the helmet in general. This helmet is designed by combining two excellent functions, the cooled helmet, so it can provide a sense of comfort to the rider, and serves as an anti drowsiness helmet for having a warning alarm when the rider is sleepy [3] that can be detected through the pulse sensor. The process of making helmets cooled and anti sleepiness can be seen in the following Table 1:
Table 1. The process of making helmets

| Figure | Further Information |
|--------|---------------------|
| ![Figure](image1.png) | Performed preparation of tools and materials, namely 9 Volt batteries, ultra battery, pulse sensor, peltier, silicone, heatsink, small fan, arduino uno, buzzer, switch, jumper cable, bolt, and jumper cable. |
| ![Figure](image2.png) | 9 Volt Battery connected with pre-programmed arduino. The arduino is also connected to the pulse sensor [2]. |
| ![Figure](image3.png) | Buzzer connected with jumper cable for longer cable. Tested by connecting it to the battery, so buzzer can sound. This indicates that the buzzer can serve as an alarm. |
| ![Figure](image4.png) | Buzzer connected to arduino. The way this circuit works, the pulse sensor will detect the pulse of the rider, if the pulse is below 70 bpm then the buzzer will sound. |
| ![Figure](image5.png) | Peltier, headsink, and small fan assembled into like the picture on the side. Small fan serves to spread the cold air produced peltier to all parts of the helmet. Meanwhile, the headsink to reduce the heat of peltier [4]. |
The small fan is connected to the Lippo Lithium battery as its energy source. Furthermore, the whole circuit is connected with the arduino. Pulse and peltier sensors use the switch as an on/off switch.

A series of tools and materials are inserted into the helmet. On the side of the helmet there is a switch that can be used as an on/off switch, so it can be used when the heat and turned off when the air inside the helmet is cool enough.

The completed tool is then tested to determine the functionality of the tool. Anti-drowsiness helmet tested its sensor and buzzer. The workings of this cooled and anti-damp helmet, in which there is peltier helmet that can provide comfort for the user when memakianya, if the helmet users feel hot, it can turn on the switch next to the helmet, so that the cooler will light and if the rider wants to turn it off press the switch button again. Furthermore, the program is made on the arduino and the sensor so it can detect the number of pulses, ie when the helmet is worn, so the rider needs to adjust the helmet tie straps on the pulse that is on his neck and the pulse sensor will detect the number of pulses. If the rider is less than 70 bpm, the buzzer will sound as a warning alarm.

Helmets are usually used to protect the head in case of a traffic accident and as an obligatory accessory in the riding. This cooled and anti-damp helmet certainly has some advantages compared to other helmets. The advantage is that a cooled helmet can provide a sense of comfort to the rider and make it more patient when riding a motorcycle, and can be a reminder for the sleepy rider.

4. Conclusion

From the process of making cooled and anti-drowsy helmets, the following conclusions can be drawn:

1. Cooled and anti-drowsy helmets can be used as a solution to reduce the number of traffic accidents that are mostly due to negligence and lack of fit.
2. Peltier can make the temperature inside the cool helmet flattened using a small fan, making it comfortable to wear.
3. The pulse sensor in the helmet can detect the pulse of the rider and its output is a warning alarm, when the driver is sleepy.
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