

Early Warning System on Motorcycle Rider Helmets Using Gyroscope Sensors

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ABSTRACT

At this time transportation is one of the important things in human life activities. One of the most widely used transportation is two-wheeled vehicles, especially motorcycles. According to the Ministry of Transportation (Kemenhub) reports that in 2021 the number of accidents caused by drivers who are drowsy is 2,140 incidents. This condition encouraged the author to design an anti-drowsiness helmet to reduce the number of accidents and avoid the possibility of accidents due to drowsy driving. The result of this study was that this tool can provide notification in the form of an early warning to motorbike drivers who are indicated to be drowsy by using a vibrating motor. If the head moves on the front, which is the Y axis 300°-360° and on the X axis the right side 20°-60° and on the left side 300°-335°, then the helmet will vibrate. If the Y and X axes of the helmet are in the normal position, the vibration will automatically turn off, and the helmet will return to normal

INTRODUCTION

At this time transportation is one of the essential things in human life activities. One of the widely used transportation is two-wheeled vehicles, especially motorcycles. Motorcycles are very popular and in great demand, because they are effective and can be used on various road terrains. The number of motorbike users in Indonesia is huge, according to the Central Statistics Agency, it will reach 94.617 in 2022.[1]

The Ministry of Transportation (Kemenhub) reports that the number of land traffic accidents in Indonesia will reach 103,645 cases in 2021. This number has increased by 3.62% compared to the previous year's 100,028 cases. This condition occurred in line with the improvement in people's mobility last year. Throughout 2020, the flow of vehicle traffic has decreased given the social restrictions imposed to suppress the Covid19 pandemic. The causes of this accident include fatigue, carelessness, illness, disorder, psychological pressure, drug influence, alcohol influence, speed limit, and drowsiness. More specifically, the number of accidents caused by drowsy drivers is 2,140 incidents [2].

In another study, a gyroscope was applied to detect balance conditions, especially to design a system that can provide notifications in the form of sounds, and timers to remind sleepy motorbike drivers. Therefore, the author wants to create a system that can detect and give warnings of drowsiness. In essence, what is proposed in this study is a device that can detect drowsiness in motorcyclists using a gyroscope sensor, and issue a warning in the form of a vibration. This system is installed on a motorcycle helmet because the input from this tool is head movement analysis.

LITERATURE REVIEW

According to research that has been done several factors affect the concentration of the driver. Based on the results of the analysis, the factors that affect concentration, the condition of the vehicle is 32%; driver's health condition by 23%; road conditions by 22%; weather conditions by 10%; conditions of family problems by 8%; environmental conditions, company management and operational problems in the field by 2%. Besides that, driving on medium and long routes will be very tiring [2]. This happens because the movements made by the driver are monotonous and last long enough to cause boredom, fatigue, and finally drowsiness [3].

Research conducted by Arthur M. Rumagit said that drowsiness when driving a motorbike or car is a condition in which a person wants to sleep [4]. However, drowsiness conditions can result in fatal things. Drowsiness can be caused by several factors, including fatigue from work, lack of adequate sleep, and others[5][6][7]. There are several types of drowsiness so a person can be categorized as sleepy or not. The drowsiness of a person, among others, can be seen from the condition of the eyelids starting to get heavy, blurred vision and the head starting to get unbalanced to hold the load so that it requires lying down and resting, this is the basis of this study. The use of a helmet will be very good when riding a motorcycle.

Warnings to prevent drowsiness are given by using a buzzer which is sounded at certain time intervals set by a timer. The time interval used is 15 minutes, which is obtained from the analysis of various surveys that have been

conducted in data collection. The downside of this approach is that it can miss sleepiness that occurs between intervals. This weakness can be corrected by detecting drowsiness that can occur at any time using a sensor that detects drowsiness. One indication that the body is in a drowsy state or a loss of consciousness is a change in the movement of the head that suddenly bends downward. One of the sensors that can be applied in this case is the gyroscope sensor which is placed on a motorcycle rider's helmet, this sensor is a tool to read changes in the movement about the x, y, and z axes as a reference [8][9].

Research that has been done by E. Setyawan about helmets that can provide drowsiness warnings using a gyroscope, that this tool can provide notifications to drivers who are indicated to be drowsy using a bell if the angular velocity of the swollen person's head exceeds 1.2 °/s concerning the Y axis [10].

METHOD

This system starts to run where the gyroscope sensor detects a movement in the helmet which is read when the helmet tilts and bends or changes the Y angle 319°-360° and changes in the X angle right 40°-70° and left 310°-340° helmet wearer then it will send direct vibrations that are carried out by the vibrator/vibrator motor during bending according to changes in the Y and X angles. If there is no change in angle, the vibrator/vibrator motor will not move.

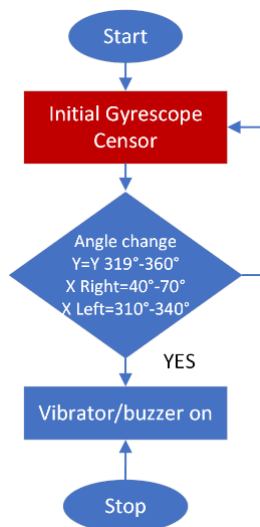


Fig. 1. Flow chart

This block diagram was created to simplify the process of designing an early warning system on a motorbike rider's helmet using a gyroscope sensor. The circuit of this system consists of 3 circuits, namely the input section, the control section, and the output section.

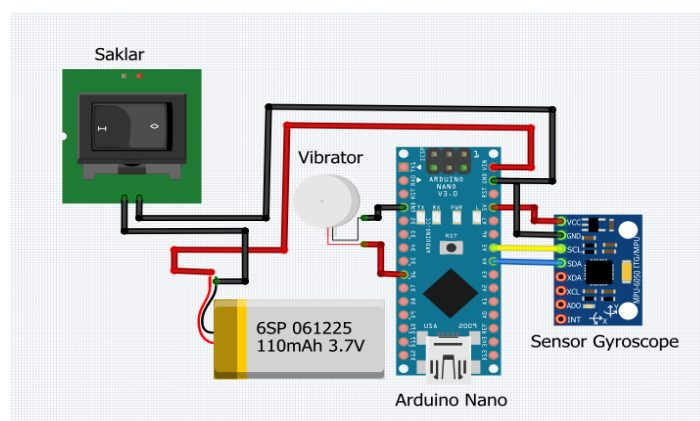


Fig. 2. System Design Diagram

Input section This section consists of a gyroscope sensor that functions to determine the motion or detect the movement of motorcycle helmet users. The control section consists of Arduino Nano which functions as a controller for

the entire circuit so that the circuit can work optimally[11]. The output section consists of a vibrator/vibrator which functions so that the vibrations coming out of the vibrator/vibrator can awaken the motorcycle driver who is wearing the helmet.

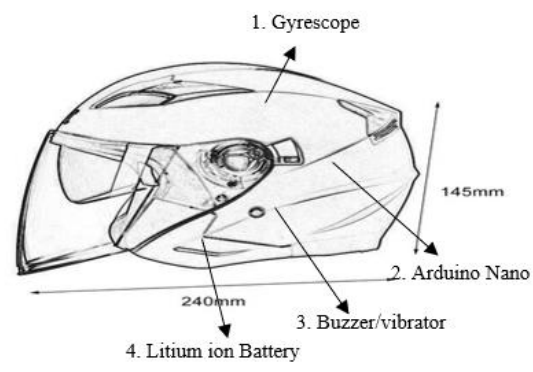


Fig. 3 Tool sketch

RESULT

Based on testing an early warning system tool on a motorbike rider's helmet using a gyroscope sensor, if the switch button is turned on, the gyroscope sensor on the helmet will detect the movement of the rider's head, when the gyroscope sensor is normal on the X axis 10° and Y 19° . If the gyroscope sensor reads the movement of the head, namely the X axis on the right $40^\circ-70^\circ$ and the left $310^\circ-340^\circ$ and on the front of the Y axis $319^\circ-360^\circ$, then the helmet will vibrate. If the helmet returns to normal or returns to the X and Y axes, the vibration will automatically turn off, and the helmet will return to normal.

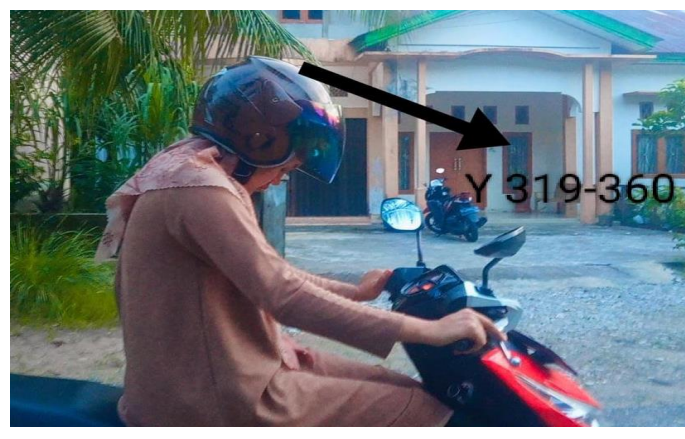


Fig. 4 Overall tool testing

In the picture above the test on the Y-axis helmet, that is, when drowsiness occurs in the front of the helmet, it will definitely bend or bend down $319^\circ-360^\circ$, the helmet will vibrate and return to normal on the Y axis 19° .

Table 1
 The Significance of The Relationship in The Model

Sample	Y-axis	Y-axis		Result
		Right	Left	
Sample 1	360°	-	-	vibrate
Sample 2	-	60°	-	vibrate
Sample 3	-	-	335°	vibrate
Sample 4	310°	-	-	vibrate
Sample 5	350°	-	-	vibrate
Sample 6	-	50°	-	vibrate
Sample 7	-	-	310°	vibrate
Sample 8	200°	-	-	not vibrating
Sample 9	-	20°	-	not vibrating
Sample 10	-	-	250°	not vibrating
Sample 11	335°	-	-	vibrate
Sample 12	340°	-	-	vibrate
Sample 13	342°	-	-	vibrate
Sample 14	345°	-	-	vibrate
Sample 15	325°	-	-	vibrate
Sample 16	347°	-	-	vibrate
Sample 17	356°	-	-	vibrate
Sample 18	333°	-	-	vibrate
Sample 19	-	22°	-	not vibrating
Sample 20	-	31°	-	vibrate

CONCLUSSION

The system can design a gyroscope sensor that can detect the angle on the helmet and will vibrate when the rider starts pressing the switch button, and when the rider ducks with an angular velocity at Y 319°-360° and returns to normal on the Y19° axis at an angle of X right 40°-70 ° and left 310°-340° and returns to normal on the X10° axis. Then it will give an early warning, namely by the vibration of the helmet. The angular speed resulting from the head movement of each sleepy person has a varying value. So it is made at an angle of Y 319°-360° and an angle of X right 40°-70° and left 310°-340°. The battery life of the early warning system tool for motorbike riders using a gyroscope sensor can last for 46 hours when it is turned on, this tool can last when going on long trips.

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