

Slope Warning System

Zeren Kaynak , Karşıyaka Efe Afyonlu ,Ozel Eraslan Anadolu Lisesi , Izmir/Turkey,

zerenkaynak@gmail.com, muhammet.coruh@eraslan.k12.tr

ABSTRACT

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Advisor: Muhammet Coruh

Accepted by Ariaian Young Innovative Minds Institute, AYIMI

<http://www.ayimi.org>, info@ayimi.org

Accidents experienced by motorcycle drivers on curvy roads are among the most frequently encountered news. The vast majority of these accidents occur when the rider loses control of the motorcycle while cornering as a result of excessive leaning while cornering. Based on these findings, it is aimed to develop a warning system that can prevent motorcycle accidents in corners and inform the user about the slope of the vehicle. "Arduino" card and MPU6050 acceleration sensor were used in the warning system produced in the study. By developing the system, it is also aimed to produce a product that will notify the driver of whether the tipper is open or closed in dump trucks.

Key words: *Motorcycle accidents, Arduino, warning system*

1 Introduction

Accidents experienced by motorcycle drivers on curvy roads are among the most frequently encountered news. The vast majority of these accidents occur when the rider loses control of the motorcycle while cornering as a result of excessive leaning while cornering. Based on these findings, it is aimed to develop a warning system that can prevent motorcycle accidents in corners and inform the user about the slope of the vehicle.

"Arduino" card and MPU6050 acceleration sensor were used in the warning system produced in the study. The MPU6050 acceleration sensor can measure the angle and thus gives the motorcycle user information about the angle of the engine with the ground momentarily. In case the engine leans 8, 16, 24, 32 or 40°, it warns the driver with changing lamp colors such as blue, yellow and red and increasing sound. In this way, the driver will be aware of the degree of incline while cornering, thanks to the colored signals and audible warning, and will be able to prevent a possible accident by taking immediate action according to the danger situation.

By developing the system, it is also aimed to produce a product that will notify the driver of whether the tipper is open or closed in dump trucks. In addition, it is aimed to find a solution to the overturning problem as a result of the work machines that we hear frequently when they reach a certain slope while working.

2 Entrance to the Problem

Many traffic accidents occur every day in Turkey. According to the Turkish highway accident statistics published by TURKSTAT for the years 2009-2018, thousands of people lose their lives due to traffic accidents every year. The leading causes of these accidents are fast entering the bends, skidding on the bends, and tilting on the bends (www.kgm.gov.tr/).

The accidents caused by the engines in the corners are frequently mentioned in the newspapers and news. When the statistics of the motor accidents that occur, it is obvious that the motor accidents that occur in the corners should not be underestimated. According to 2018 data, approximately 16% of the accidents in our country occur on bends (Table 1). Curves are one of the most important issues and problems for highways. In terms of road safety, the

geometric standards of the bends should be adjusted very well. It is very important to raise the awareness of the drivers in the bends that may create an accident hazard for the drivers to reduce the accident rates. Entering the bend at a high speed will cause the vehicles to skid on the bends (<http://ogmmateryal.eba.gov.tr/>). Drivers need to be aware of the incline of their engines and trucks while cornering and whether the grade of the incline is dangerous for them.

Table 1: Statistics of the motor accidents (2018)

horizontal path	residential area		out of town		Total	
	number of accidents	%	number of accidents	%	number of accidents	%
straight road	125674	89.82	30808	66.1	156482	83.89
bend	12096	8.64	10020	21.5	22116	11.86
dangerous bend	2152	1.54	5782	12.4	7934	4.25
Total	139922	100	46610	100	186532	100

Figure (1) also shows the rate of the issues which cause motorcycle problems. It is seen that 38.2% of the motorcycle accidents are the result of over-shooting bends and not knowing the danger of the slope.

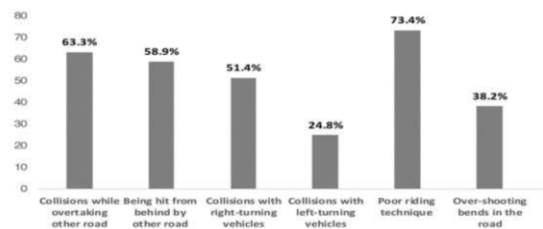


Fig.1: Motorcycle problems

When the measures taken to prevent these accidents were investigated, it was seen that some of the bends were inclined to support the rider in case of losing control, but this configuration was not a solution to prevent motorcycle accidents. We decided that ignoring this problem will allow the increase in accident and death rates. So that an effective, applicable, innovative, and cost-effective solution should be produced as soon as possible.

In addition, especially in recent years, many accidents have occurred because truck dumpers are often left open and these accidents have caused loss of life and property. There is no solution to prevent these accidents due to the

absent-mindedness of the driver. Similarly, no system can warn the construction equipment operators in case of danger of tipping due to excessive bending while working. To prevent the user from losing control and causing an accident while the motorcycle is turning as it is leaning on the bend, a system has been developed to determine the inclination of the motorcycle and warns the rider with visual and auditory signals. While developing this system, the principles of rotational physics (Fig. 2) were taken into account (Giancoli, 2009).

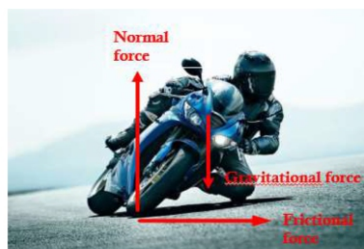


Fig. 2: The force on the motorcycle in a rotational road

The produced light and audible warning system warns the rider of the slopes of the motorcycle to the right or left during the journey, and riders will be informed about the degree of inclination of their motorcycle and whether that slope is dangerous or not, with colored signals and an auditory warning system, thus taking immediate action in a dangerous situation, the rider can prevent an accident.

3 Material and Method

Firstly, motorcycle users were interviewed to determine the root cause of the accidents on curvy roads.

Motorcycle users mentioned that they tilted the engine while turning the corners and that the engine skidded because they did not know the slope.

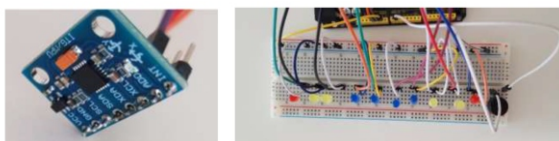


Fig. 3: MPU6050 acceleration sensor and circuit

Based on this, the hypothesis that "the driver knows the slope of the engine while driving around the bend and the driver is warned in case the slope reaches dangerous points prevents possible accidents" was established. While developing a prototype, the MPU6050 acceleration sensor included in the "Arduino" coding kit was used (Fig. 3) In addition, 10 mushroom LEDs and 1 buzzer were used for the warning system. The codes, inspired by open-source codes and optimized for prototype circuits.

4 Results and Discussion

The created circuit informs the right or left inclination of the motor. The first blue lamp lights up when the motor tilts 8° to the right from the vertical axis. When tilted at 16° , two blue lamps are on.

When the engine is tilted at 24° , two blue and one yellow lamp are on. At the same time, the buzzer starts to beep intermittently. When the engine leans 32° to the right, two blue and two yellow lamps are on and the buzzer beeps intermittently. When the engine leans 40° to the right, two blue, two yellow, and one red lamp are on. In addition, the buzzer beeps continuously when the red lamp is on.

As explained above, the light and sound warning system

work effectively on slopes to the right, as well as on slopes to the left. Thus, a system was produced that informs the motor driver how many degrees the motor is tilted to the right or to the left (Fig. 4).



Fig. 4: The produced warning system and integrated system on a prototype

By establishing a similar system, the tipper clearance warning system for dump trucks and the rollover warning system of the construction equipment will be developed. In addition to the materials used in the system we have developed for the tipper and construction equipment, a screen will be added so that the user can see the angle of the tipper and construction equipment with the horizontal.

There is no other product produced to prevent or reduce the accidents caused by motorcycles on bends.

No system indicates whether the truck dumpers are open or not and informs the inclination of the construction equipment. A viable, innovative, and cost-effective solution has been developed that will prevent many fatal accidents and property damage. A system to be developed similarly will be integrated into trucks, and a possible accident will be prevented by measuring whether the tipper is open or not and warning the rider by measuring the angle of the tipper. With the same system, the tipping problem will be solved by informing the user of the slope of the work machine while it is operating.

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