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Collision Avoidance System for Motorcycles

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Abstract: ***In a country where a large section of the population heavily depends on motorcycles to commute work, accidents due to unskilled driving and absence of mind are very common. This becomes especially dangerous with young drivers who have just received their driving license and have not yet developed the reflexes necessary to make the right decisions while driving a motorcycle. We aim to provide a sophisticated solution to this problem that will ensure the safety of such drivers.***

I. INTRODUCTION

Our objective is to develop a system that predicts when a motorcycle is on a collision course with another vehicle or any object, warns the driver of the potential danger and also takes control of the vehicle if required.This system uses five components; ultrasonic sensor, vehicle speed sensor processor, warning system, and linear actuator. The processor, using data from the vehicle speed sensor, and calculates the stopping distance for the vehicle at that particular speed. While doing so it also takes into consideration the time taken by the rider to respond. The ultrasonic sensor measures the distance of an obstacle ahead of the motorcycle in real time and continuously feeds this data to the processor. The processor compares the stopping distance and the measured distance. When the measured distance becomes less than or equal to the stopping distance, the processor knows that the motorcycle is on a collision course.

A. Warning System

The warning system consists of an LED light on the instrument cluster of the motorcycle and vibrators on each of the handles. When the processor detects a potential collision, the LED light is turned on and the vibrators in the handles vibrate to let the rider know of a potential collision. Most accidents will be avoided at this very stage if the rider is skilled and alert enough.

B. Autonomous Braking

Most adequately skilled riders respond to a potential collision in 0.44 seconds [2]. Hence this system provides the rider 0.5 seconds to respond. If the rider does not respond within this time, the system, 1) Applies the brakes, 2) Brings the throttle to zero, and 3) Disengages the clutch. This way it prevents the motorcycle from colliding with the obstacle ahead of it.

C. Release of Brakes

The brakes will be released when any one of the following conditions will be satisfied:

1) The motorcycle comes to a complete stop
2) The obstacle ahead of the motorcycle moves out of the stopping distance.

D. Equations

The stopping distance of the motorcycle is given by:

$$D = vt + v^2/2\mu g \quad (1)$$

Where, D = Stopping Distance (m)
v = Instantaneous velocity (m/s)
t_r = Rider Response Time (s)
μ = Coefficient of friction between road and tyre
g = Acceleration due to gravity (m/s^2)

The measured distance of the obstacle ahead of the motorcycle is giver by:

$$D_m = ct/2 \quad (2)$$

Where,

c = Velocity of sound in air = 343 m/s
t_e = Time taken to receive echo (s)

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II. EXPERIMENTSL RESULTS

The experimental results are subject to the following assumptions:

A. The coefficient of friction has been assumed to be 0.90 for dry asphalt/concrete roads.
B. The velocity of sound in air is 343 m/s
C. The stopping distance also takes into account the distance travelled by the motorcycle in 0.5 seconds.

Fig. 1 shows a comparison of the calculated stopping distances and the observed stopping distances of the motorcycle at different speeds (X axis).

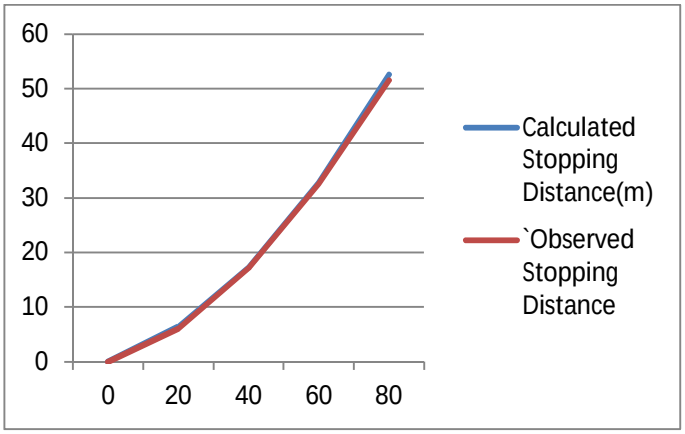

Figure 1

III. CONCLUSION

The 'Collision Avoidance System' that we are conceptualising will be a giant step forward in motorcycle safety. Numerous accidents are caused by negligent driving and underdeveloped reflexes. It is these immaturities and ineptitudes that we intend to take care of. As of now, this technology is only in its most primitive stage. More research and collection of data through experiments will be needed to make this system infallible. Therefore, with this necessary research conducted and used to improve this system, we hope to see safer roads for motorcycles in the days to come.

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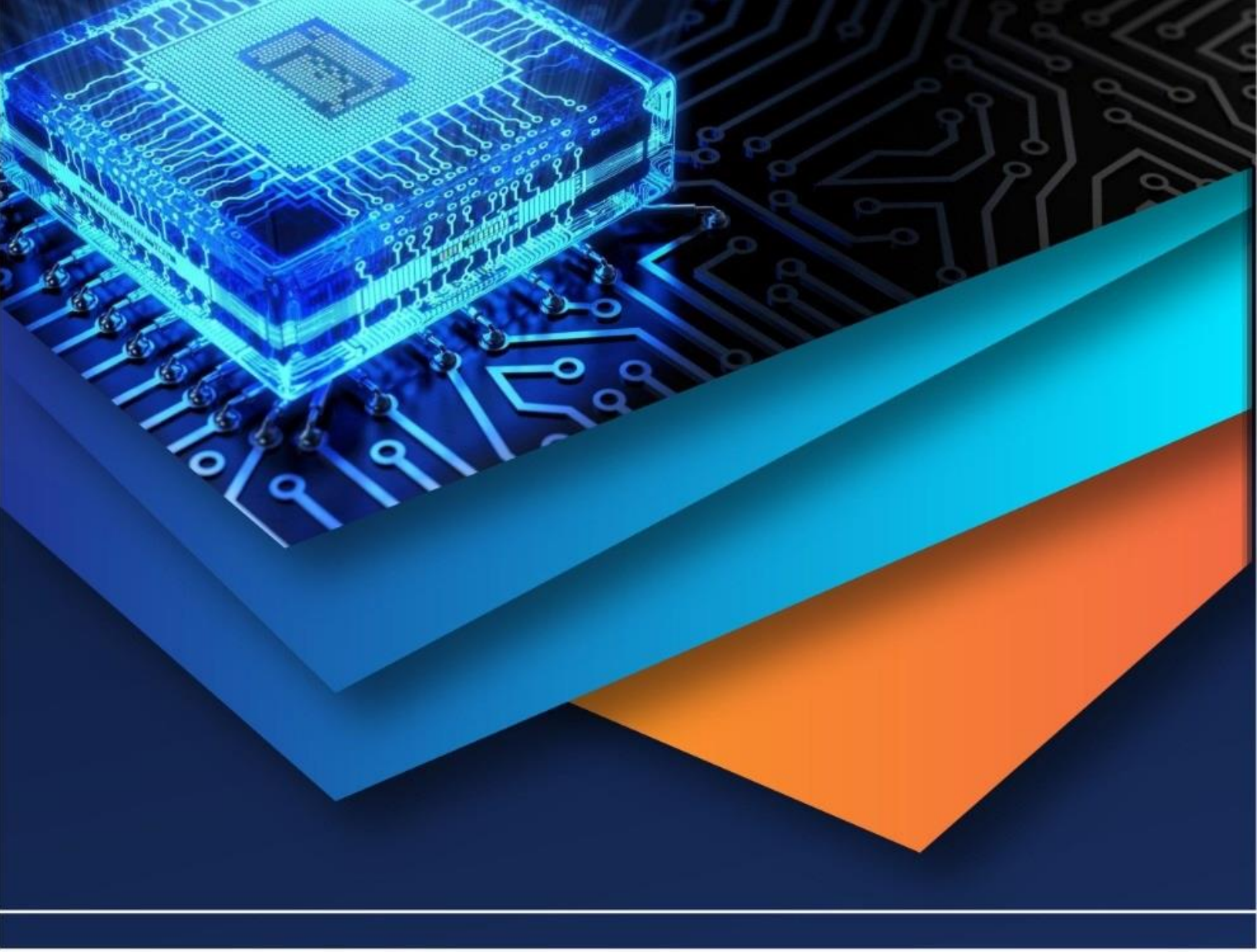

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