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Real Time Drowsiness Detection System and Obstacles Avoiding System

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Abstract - Drowsy driving poses a significant threat to road safety, contributing to a substantial number of accidents worldwide. To mitigate this risk, we present a Real-Time Drowsiness Detection and obstacle avoiding system (RTDDOAS). This system is a smart safety device for car drivers that can detect sleep by using eye detection sensor and alert them by using alarm and vibration motor.The proposed system employs a combination of facial recognition, eye tracking, and physiological sensors to accurately assess the driver's level of alertness. Facial landmarks are detected and tracked in real-time to analyze facial expressions and detect signs of drowsiness, such as drooping eyelids. Concurrently, eye tracking technology monitors the driver's eye movements and blink patterns to identify indicators of fatigue.Machine learning algorithms, trained on a diverse dataset of drowsy and alert driving behaviors, are utilized to classify the driver's state and predict the likelihood of impending drowsiness. These algorithms continuously adapt and improve their performance through real-time feedback, ensuring robust and reliable detection capabilities.In the event of detected drowsiness reaching a critical threshold, the RTDDOAS activates an obstacle avoiding mechanism to safely bring the vehicle to a stop, whenever they find obstacles by altrasonic sensor. Utilizing vehicle-to-infrastructure communication systems, the system identifies nearby safe locations for parking and initiates the process autonomously, minimizing the risk of accidents and ensuring the well-being of both the driver and other road users.

Keywords: Drowsiness detection, real-time monitoring, computer vision, machine learning, emergency parking system, road safety.

1. Introduction

A vast majority of people have experienced drowsiness at some point while they were driving their vehicles. Drowsiness is mostly accompanied by lack of mental agility, lethargy and weakness. Most road accidents happen when the drivers experience drowsiness and this needs analysis (Alioua et al., 2014). Gander et al. (1993) did an analysis on aviation crew members and reported the psychological and physiological effects of sleep disorders which can be used to understand the sleep patterns for computerized studies. Essential characteristics of the drowsiness among drivers have been used by researchers to determine the drowsiness level (Wang & Shi, 2005). These systems monitor the state of driver drowsiness through a webcam with night vision in a real time environment and when drowsiness is detected, the system sends a warning. The objective of these systems are to improve the safety of people and road safety with the use of automated detection and alarm to avoid accidents caused by driver drowsiness.

2. Literature Review

[1] HANANE LAMAAZI, AISHA ALQASSAB, RUBA ALI FADUL ET.AL "Smart Edge-Based Driver Drowsiness Detection in Mobile Crowdsourcing" Traffic accidents caused by drowsy drivers represent a crucial threat to public safety. Recent statistics show that drowsy drivers cause an estimated 15.5% of fatal accidents. With the widespread use of mobile devices and roadside units, these accidents can be significantly prevented using a drowsiness detection solution.

[2] Mohammed Hayyan Alsibai,Syafiq Fauzi Kamarulzaman et.al "Real time emergency auto parking system in driver lethargic state for accident preventing" This paper is presenting a safety driving and accident preventing system which uses a vision sensor to detect driver drowsiness and lethargic states.

[3] Damian Sałapatek, Jacek Dybała, Paweł Czapski et.al "DRIVER DROWSINESS DETECTION SYSTEMS" The development of technology allows introducing more advanced solutions in everyday life. This makes work less exhausting for employees, and also increases the work safety. Vision-based systems are becoming more popular and are more widely used in different applications.

[4] Anusha A, Jagadamba M, Raksheetha H R et.al "Driver Drowsiness Detection System in Automotive Vehicles" Road accidents are usually caused by driver carelessness. The major carelessness exhibited by the driver are drunken behavior and negligence. The driver drowsiness detection system in automotive vehicle focuses on abnormal behavior exhibited by the driver using a microcontroller, the Raspberry pi single board computer.

[5] ALAGU MEYYAPPAN KAILASAM, AYIKUMAR MOHAN et.al "DROWSINESS DETECTION AND PARKING ASSISTANCE FOR DRIVERS" Traffic on road has increased considerably due to active economy, especially in developing countries. Road accidents have increased with the increasing traffic.

[6] Apurva Mirge, Priya Sharma, Kashmira Shendge et.al "Detection of Driver Drowsiness Using Eye Blink Sensor" Nowadays, drowsy driving has become a leading cause of accidents. The mechanism for detecting fatigue and sleepiness while driving has been categorized into three broad approaches, including vehicle-based, physiological-based, and behavior-based approaches.

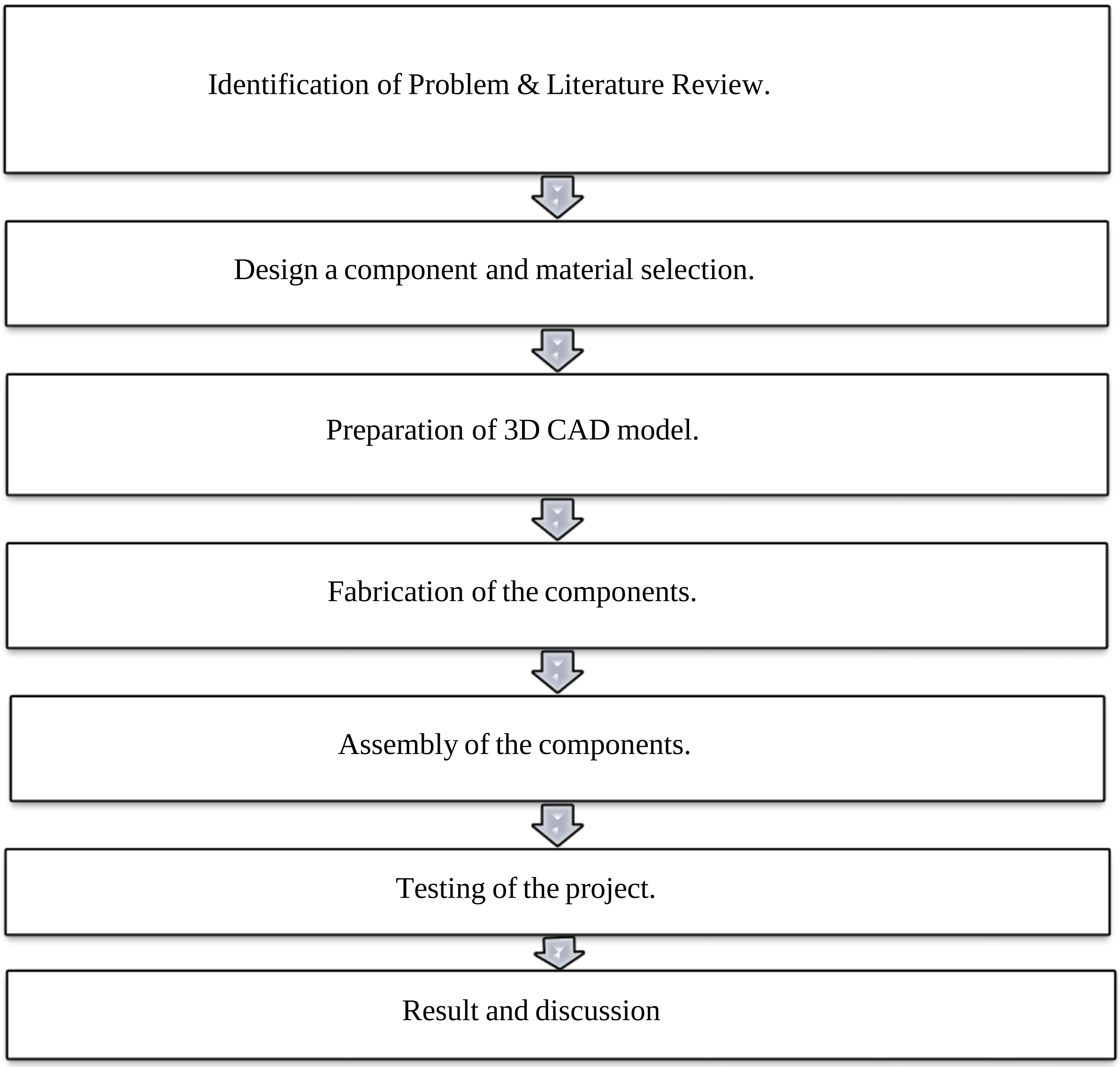
[7] Alamgir Hossan,Faisal Bin Kashem, Md. Mehedi Hasan et.al "A Smart System for Driver's Fatigue Detection, Remote Notification and Semi-Automatic Parking of Vehicles to Prevent Road Accidents" Drowsy driving is one of the main reasons of road accidents. Different techniques have been reported in literature to detect driver's drowsiness, but almost all the prevailing systems only alert the driver if drowsiness is detected.

[8] Yaman Albadawi , Maen Takruri et.al "A Review of Recent Developments in Driver Drowsiness Detection Systems" Continuous advancements in computing technology and artificial intelligence in the past decade have led to improvements in driver monitoring systems.

[9] Prashant Dhawde, Pankaj Nagare, Ketan Sadigale, Darshan Sawant et.al "Drowsiness Detection System" The major aim of this project is to develop a drowsiness detection system by monitoring the eyes; it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident and feature of slowing down the vehicle if driver fails to respond to the alarm and ultimately stops the vehicle.

[10] Elena Magán , M. Paz Sesmero et.al "Driver Drowsiness Detection by Applying Deep Learning Techniques to Sequences of Images" This work presents the development of an ADAS (advanced driving assistance system) focused on driver drowsiness detection, whose objective is to alert drivers of their drowsy state to avoid road traffic accidents

3. Block Diagram

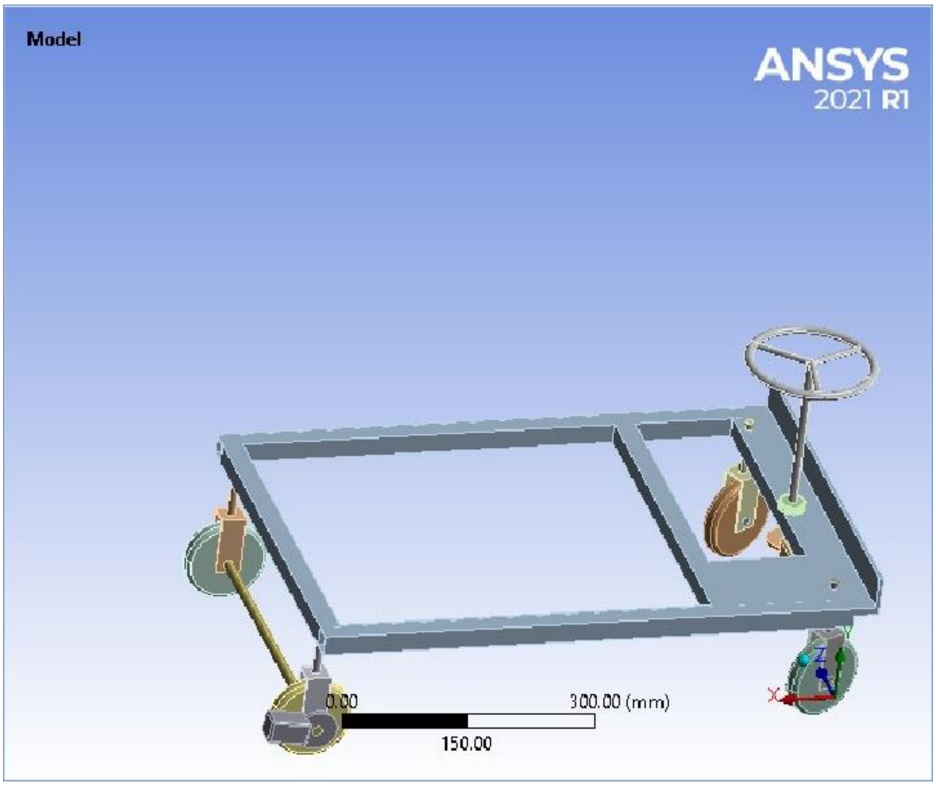


4. Methodology

ANSYS

Project

First Saved	Thursday, November 23, 2023
Last Saved	Thursday, November 23, 2023
Product Version	2021 R1
Save Project Before Solution	No
Save Project After Solution	No

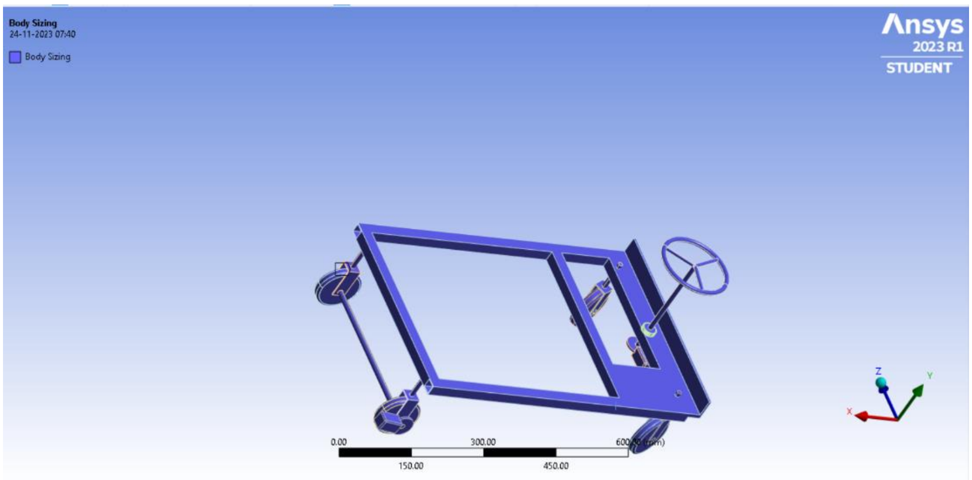


4.1 Model

Geometry

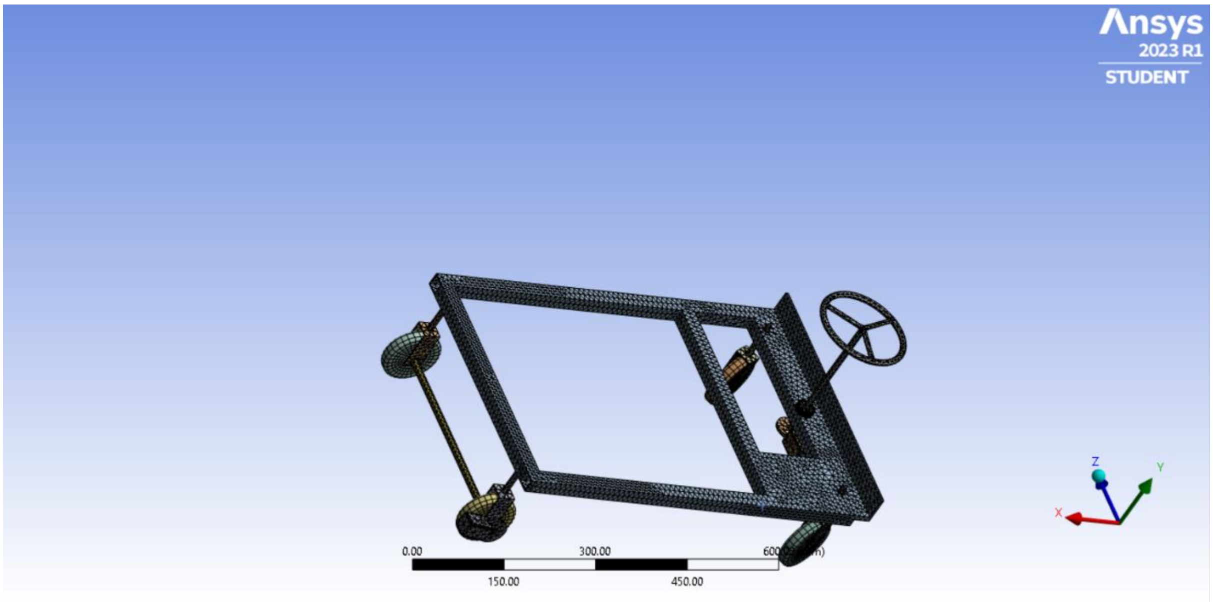
Object Name	*Geometry*
State	Fully Defined
Definition	
Source	E:\Protect solutions\BE 2023-24\Km61\new data\step (1).STEP
Type	Step
Length Unit	Millimeters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	
Length X	814.6 mm
Length Y	414.31 mm
Length Z	507.2 mm
Properties	
Volume	2.3091e+006 mm³
Mass	18.126 kg
Scale Factor Value	1.
Statistics	
Bodies	20
Active Bodies	17
Nodes	92740
Elements	42429
Mesh Metric	None
Update Options	
Assign Default Material	No
Basic Geometry	

Options	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Independent
Parameter Key	ANS;DS
Attributes	No
Named Selections	No
Material Properties	No
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	Program Tolerance
Decompose Disjoint Geometry	Yes



4.2 MESHING

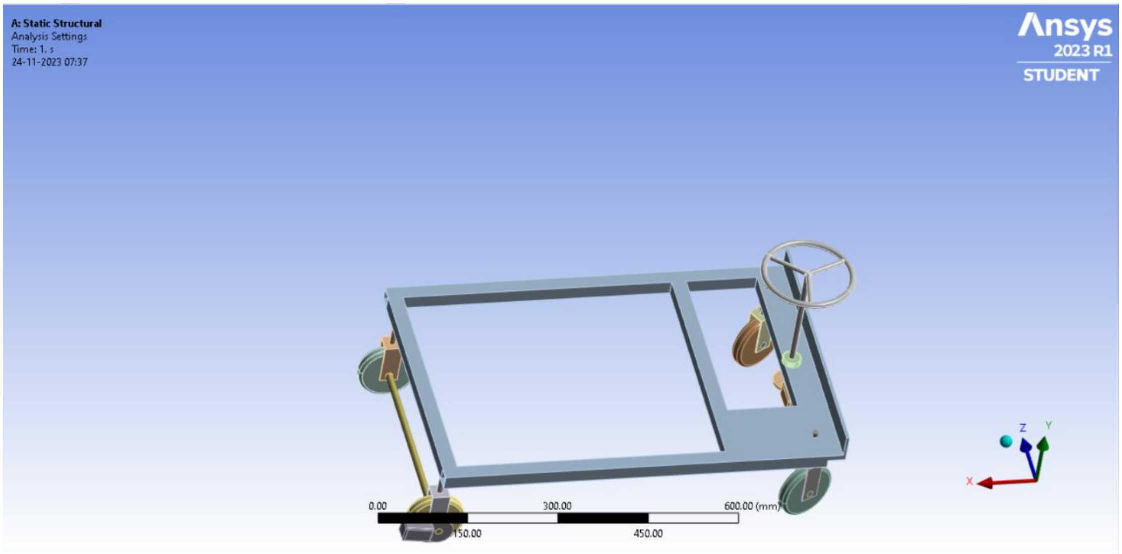
Object Name	*Body Sizing*
State	Fully Defined
Scope	
Scoping Method	Geometry Selection
Geometry	16 Bodies
Definition	
Suppressed	No
Type	Element Size
Element Size	10.0 mm
Advanced	
Defeature Size	Default
Behavior	Soft

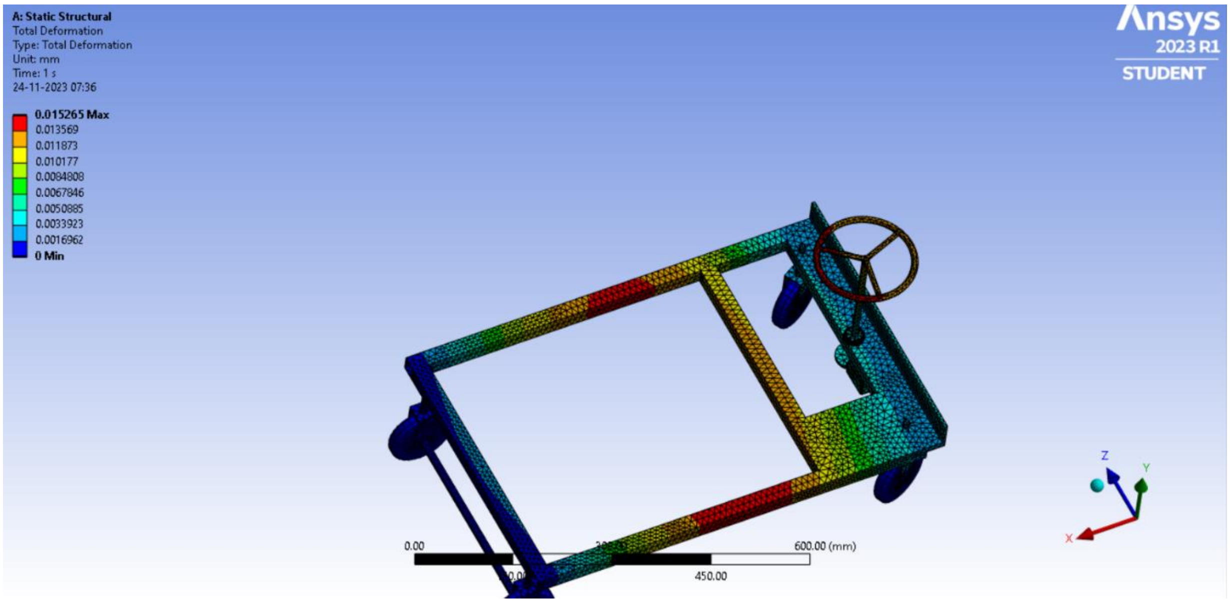


4.3 STATIC STRUCTURAL ANALAYSYS

Object Name	*Static Structural (A5)*
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22. °C
Generate Input Only	No

Object Name	*Standard Earth Gravity*
State	Fully Defined
Scope	
Geometry	All Bodies
Definition	
Coordinate System	Global Coordinate System
X Component	0. mm/s² (ramped)
Y Component	-9806.6 mm/s² (ramped)
Z Component	0. mm/s² (ramped)
Suppressed	No
Direction	-Y Direction





5. MATHEMATICAL CALCULATION

1) Rack :-

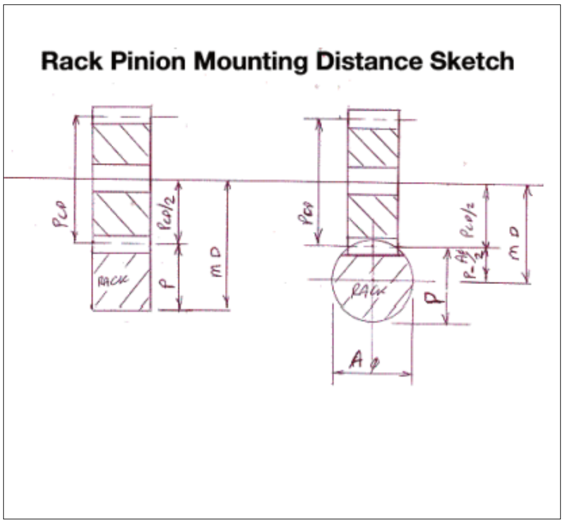
To calculate Rack MOD (Module) :

a) Measure distance of Pitches, as shown below

b) Divide this number by

c) Then divide the resulting number again by π (pi), this would give us the required Module.

Module $= \dfrac{\frac{(\text{Distance of 85 itches mm})}{161}}{\pi}$



Distance of 161 Pitches = 507 mm

Distance of one Pitch = 3.17 mm

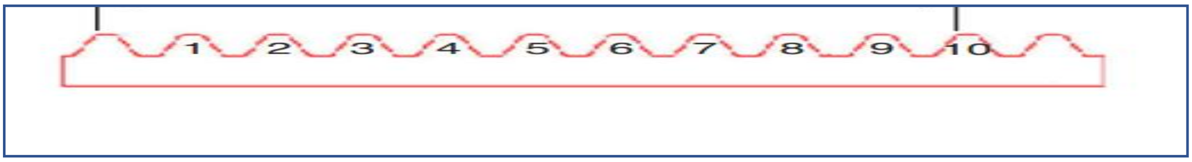
Required Mod = $\frac{3.149}{\pi}$

Required Mod = 1

for e.g. for total distance as shown in fig.

Fig no. 3.1.1

Rack And Pinion Mounting Distance Sketch



2) pinion (spur gear)

To calculate Pinion (Module):

Module = $\frac{reference\ diameter}{number\ of\ pitches}$

Module = $\frac{40}{40}$

Module = 1

Wiper Motor Torque

Motor Torque = Force x Radius

Force = mass x gravity

=12 KG x 9.81

= 117.72 N

Wheel = 4 inch = 0.101 m

Radius = D/2

= 100/2

= 50mm = 0.05 m

Working Torque = 117.72 x 0.05

= 5.88 N.M

Note :

stall torque:201

It is same torque produced by motor when it run at stall speed

i.e. motor sun at max. current i.e stalled.

Stall torque of the wiper motor is 9 N.M

Power Of Wiper Motor

Voltage of wiper motor = 12V

Current of wiper motor = 2-10 A

Speed of wiper motor = 55 RPM

Power (input) = Volte x Current

= 12 x 10

= 120 Watt

For vary speed of motor we need to vary Voltage, VαS

To vary torque of motor we need to vary current, Iατ

Power (output) = 5.88 x [2 x 3.14 x 35 / 60]

= 21.55 watt. (On loading condition)

Maximum Power (output) = 2 x 3.14 x Nmax x τ / 60

= 2 x 3.14 x 55 x 5.9 /60

= 34 watt

Speed Of Vehicle

speed of vehicle = Distance/Time

circumferance = 2 x Π x r

= 2 × 3.14 x 0.05

=0.314 mm

rpm x 0.314 = 35 X 0.314

=11 m

11m distance cover in 1 min at 35 rpm

speed = 11/ 1

=11 m/min

= 0.183 m/s

6. Results and Discussion

The implemented real-time drowsiness detection and emergency parking system demonstrated robust functionality during extensive testing. The eye movement sensors accurately detected signs of drowsiness, triggering immediate alerts through the alarm and vibration motor. The ultrasonic sensor effectively identified obstacles, facilitating prompt emergency parking responses. Data logging capabilities provided valuable insights into driving patterns and potential areas for improvement in road safety awareness. During the testing phase, the system exhibited consistent performance across various driving conditions. The integration of components such as wheel motor, seat vibrator motor, and ultrasonic sensor proved successful, contributing to the overall efficacy of the safety device.

Discussions with the project progress assessment panel, including Prof. Dr. S. Y. Bhosale and other esteemed members, provided valuable feedback on system performance and potential enhancements. The feedback loop allowed for iterative improvements, ensuring the reliability and accuracy of the system.

7. Conclusion

In conclusion, the Real-Time Drowsiness Detection and Emergency Parking System represents a significant stride in addressing the pressing issue of drowsy driving. By integrating advanced sensors, including eye movement sensors and the SR-HC04 ultrasonic sensor, coupled with smart alert mechanisms, we have successfully developed a comprehensive safety device. This system not only accurately detects signs of driver drowsiness but also ensures prompt emergency responses through alarms and vibration motors, enhancing overall road safety.

Through meticulous design, fabrication, and rigorous testing, the project demonstrated consistent and reliable performance across diverse driving conditions. The collaborative efforts of the project team, guided by Prof. Dr. S. Y. Bhosale, and the insightful feedback from the Project Progress Assessment Panel, including Sampat Patil Sir, Nalawade Sir, and Pawar Sir, played a pivotal role in refining the system.

The implemented data logging capabilities provide a valuable resource for understanding driving patterns, contributing to road safety research, and fostering awareness. As we move forward, the success of this project opens avenues for future advancements, potential collaborations with the automotive industry, and the integration of our system into broader initiatives dedicated to reducing road accidents and cultivating responsible driving practices. The Real-Time Drowsiness Detection and Emergency Parking System stands as a testament to the potential of technology in enhancing driver safety and promoting a safer, more conscientious driving environment.

8. Future Scope

The scope of the “Real time drowsiness detection and automatic parking system” extends into several promising areas for future development and enhancement are as follow:

Advanced Machine Learning Algorithms

Integration with Autonomous Vehicles

Cloud-Based Analytics

Collaboration with Automotive Manufacturers

International Road Safety Initiatives

Continuous Sensor and Hardware Advancements

User Interface and Experience Enhancements

Regulatory Compliance

Global Partnerships

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