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SLOT	TE1
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FEASIBILITY ANALYSIS OF OUR PROPOSED SYSTEM

Technical feasibility

Since our system uses a hybrid approach which detects drowsiness among drivers based on two visual aspects of drowsiness (eyelid movements and yawning), it gives precise results making it technically feasible to use this approach in accurate driver drowsiness detection. The system adds up results of both the parameters, if both these parameters cross the threshold value, driver is then given an alert through an alarm.

Moreover, it involves use of a web camera introduced inside the automobile to get the picture of the driver. Web camera is easy to install within the automobile with the introduction of multipurpose android like screens as a replacement for radios. Despite the fact that the camera creates a video clip, our system applies a developed algorithm on each edge of the video stream to convert the video into image frames. Driving at the night can make the eyes open to have a texture like closed eyes. The frames are converted to grayscale to avoid difficulty in classifying dark frames to some extent. Also in the night, the webcam should be able to take clear pictures with lack of light. Besides lighting, the distance between the face and the camera can also affect the classification process. Face distance that is too far away from the camera can make the eyes become narrower and make the eyes open has a texture like the eyes closed. To overcome this, resizing of the frame can be done to make it bigger but enlarging the image resolution can be at risk with the longer the system computing time.

For facial detection our system uses facial landmark detector included in the dlib library which is an implementation of the One Millisecond Face Alignment with an Ensemble of Regression Trees paper by Kazemi and Sullivan (2014). This algorithm is proven and tested to give very good results in real time and more importantly has a very good speed. But this algorithm doesn't give high accuracy when face is at an angle to the camera. In this case the webcam positioning becomes crucial.

Eye Aspect ratio of the open eye used to calculate eye blinks has a small variance among individuals, and it is fully invariant to a uniform scaling of the image and in-plane rotation of the face which makes its usage very feasible.

Mouth detection is done using large colour difference between the lips and face. The geometrical features of the face and relative location of the mouth with respect to eyes are exploited to further verify the validity of the detected mouth.

Use of alarm for alerting the driver in case of drowsiness is an extremely viable solution for alerting the driver, as the system uses existing sound system of the vehicle.

Along with alarm, the system will also send a message to the emergency contact given by the driver which will contain the location of driver. With GPS pre-installed in most of the automobiles these days, sending location is an extremely feasible feature. A problem which can be faced in this feature is if the driver is at a remote location with inadequate cellular connectivity the message might not reach the recipient in right time.

Overall, it is technically feasible to deploy this system, we might face some problems in specific use cases but the advantages of the system outweigh minor short comings.

Social Feasibility

Over the years the driver drowsiness is one of the major causes of car accidents in the world. Many researches and surveys have estimated that about 1.35 million drivers have been involved in drowsiness related accidents in the past 5 years. Speaking of our country, up to 25% of road accidents are fatigue related. According to the World Health Organization's Global Road Safety Report, there were 1.6 million deaths worldwide in 2019, of which 1,72,485 were road deaths in India.

Life is precious for all of us and so we will be more than willing to incorporate this additional safety feature to prevent deaths due to driver drowsiness. Our hybrid driver drowsiness detection system can have a huge social impact and is capable of increasing safety standards manyfold.

Moreover, it will benefit vulnerable road users (pedestrians, cyclists and motorcyclists) as well as users and non-hazardous vehicles. So, the people will be quite interested in promoting its usage in vehicles.

Most important hurdle here is to gain trust of the people. People should have full faith that the system provides accurate results, otherwise they might have reservations adopting a new technology. We can overcome this by providing consumers with enough demos and evidences that the system works with high level accuracy.

Overall, people won't have any reservations adopting this system if it provides good level of accuracy while detecting the drowsiness state of the driver.

Economic Feasibility

Project cost

The main cost involved in this system will be for web cam installation. Since it is a one-time purchase, its economically feasible to invest a bearable cost for the same. Webcam's can typically cost between Rs 1000 – Rs 5000 depending on the quality the consumer wants to use.

For running our python script, we can utilize the android screens (replacement of radios in most cars) to make it cost efficient and feasible.

The process of alerting the driver will effectively be very cost efficient as it will use the vehicle's sound system.

Overall, the system can be made economically feasible to deploy by using the existing vehicle systems.

Operations and maintenance cost

Operational cost involved in the project will be mainly of sending the messages through a cellular network. Which nowadays with the invent of 4G data available at a bare minimum cost is very economically feasible.

Anything involving technology requires maintenance, although for this system the maintenance cost will not be much as it is a stationary module embedded within the vehicle which implies that there won't be much damage in the functioning of the web cam over a very long period of time. There might be small costs incurred in case of some technical failures which are very much bearable.

Overall, the system's operational and maintenance cost is quite low and can be used efficiently at a minimum cost.

Environmental Feasibility

As such, there are no environmental impacts on the working of our proposed system and it is capable of working irrespective of the environmental conditions.

In case of heavy rains, there is a possibility to have poor cellular or 4G network which can cause delay in sending driver drowsiness alert to the emergency contact.

Also, the system does not need any extra resources and the little support it needs for camera battery can be either supplied by car battery or a small 9V battery. All these doesn't negatively affect the environment.

Political Feasibility

Our government actively works towards reducing the deaths caused due to driver drowsiness in the country. NHTSA (National Highway Traffic Safety Administration) is the government body which looks after this issue, some of its notable contributions include the following:

- In 2015, NHTSA convened the forum *Asleep at the Wheel: A Nation of Drowsy Drivers* during the National Sleep Foundation's National Drowsy Driving Prevention Week. This meeting included more than 100 participants from many diverse organizations, setting the stage for a national coordinated effort by bringing together motor vehicle and highway safety experts with sleep/circadian science experts and the sleep medicine community.
- In 2016, NHTSA released a strategic plan, *Drowsy Driving and Research Program Plan*, addressing six broad focus areas: Measurement and Problem Identification, Public Awareness and Education, Policy Development, High-Risk Populations, Vehicle Technology, and Infrastructure.

Since this project is capable of creating a huge social impact as it can help save thousands of lives, government will be more than willing to promote the use of this system in all vehicles. This system can be considered under the *Drowsy Driving and Research Program Plan, 2016*

which promotes enhancing vehicle technology and infrastructure to prevent deaths due to driver drowsiness.

Only concern for this project is that it should meet the standards set by government related to the accuracy of the system developed. Since our system proves to be quite accurate, it can meet the required safety standards to acquire the licence required to use this system commercially.

Overall, this project has high political scope in terms of feasibility and usage. This project can be directly come under government scheme further promoting its usage.

Demographic Feasibility

Since our system is product-based and not a service-based model, its use case is in all areas where vehicles are used. It is more about targeting the right people and efficient distribution. This system can be used by all people who own vehicles. Our target audience are specifically truck drivers as they travel over long distances more during the night. So, our system is demographically flexible and can be distributed across the country to be used by vehicle owners in dire need of this product.

For installing and setting up in vehicles, we can have the product distributed to various automobile dealers with proper installation instructions so that they can install in the vehicles of customers who need this feature in their vehicle very easily.