A Review on Real time Drowsy Driver Detection in Digital Image Processing

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***Abstract*— Consistently the amount of death and injuries are expanding in accidents because of human errors. Drowsiness while driving is a dangerous and it is exceptionally hard to distinguish. After liquor consumption; drowsiness is the subsequent driving reason for the street mishaps. People are conscious about the risk of drinking and driving but don't realize the dangerous of drowsiness because no instruments exist to measure the driver drowsiness. On the off chance that the Driver neglecting to focus on driving it lessens the driver response time and hinder controlling conduct. Driver drowsiness can cause a several physical and economical losses. One approach to recognizing driver's drowsiness is to notice the driver with his driving, if driver not focusing on driving cautions the driver with the alert sound. In this paper, we survey and talk about the different identification strategies for distinguishing driver's drowsiness. There are several researches have been done till now but somewhere somehow they suffers due to accuracy especially at real time.**

Keywords*— Drowsiness Detection, Face Detection, Computer Vision, Support Vector Machine (SVM), OpenCV, Machine Learning, Non-Linear SVM Model.

I. INTRODUCTION

Driver drowsiness has been the fundamental issue for innumerable incidents because of sleepiness, drawn-out street condition, and troublesome environment [1]. Every year, the National Highway Traffic Safety Administration (NHTSA) and World Health Organisation (WHO) have reported that approximately 1.35 million people die due to vehicle crashes across the world. By and large, mishaps occur because of inadequate method of driving [2]. These circumstances emerge if the driver is addicted to liquor or in drowsiness [3]. The most extreme sorts of deadly mishaps are perceived as a serious factor of sleepiness of the driver. At the point when drivers nod off, the control over the vehicle is lost [4]. There is a need to configuration brilliant or smart vehicle framework through various techniques [5]. Sixteen Indians died in road mishaps every hour. As indicated by the Global Road Safety Report 2015, total 141,526 persons were killed and approximately five lakh individuals harmed in India due to road accidents. However this number isn't as expected assessed on the grounds that all mishaps are not answered to the police. In the US consistently approximately 100,000 accidents happens because of driver drowsiness or exhaustion assessed by National Highway Traffic Safety Administration (NHTSA). National Highway Traffic Safety Administration revealed that in 2013 on account of driver drowsiness 72,000 accidents, 44,000 wounds and 800 passings happened. In this day and age, each individual uses a vehicle. It is normal considered as extravagance yet it has now become a need in an average person's life. Individuals are especially worried about their wellbeing and furthermore the vehicles security is it if there should arise an occurrence of robbery or in the event of a mishap. Engine vehicles are used for some, reasons like for shipping overall population, things and furthermore private excursions. During long driving hours the driver gets drained and the individual inclination languid yet continues driving for arriving at the endpoint early. The driving in non-safe condition because of driver will in general endeavor. At the point when the individual feels sleepy the person in question actually continues driving disregarding the way that it is unsafe. The individual in question nods off and the vehicle is not any more in charge and slams into different vehicles on road prompting loss of numerous lives.

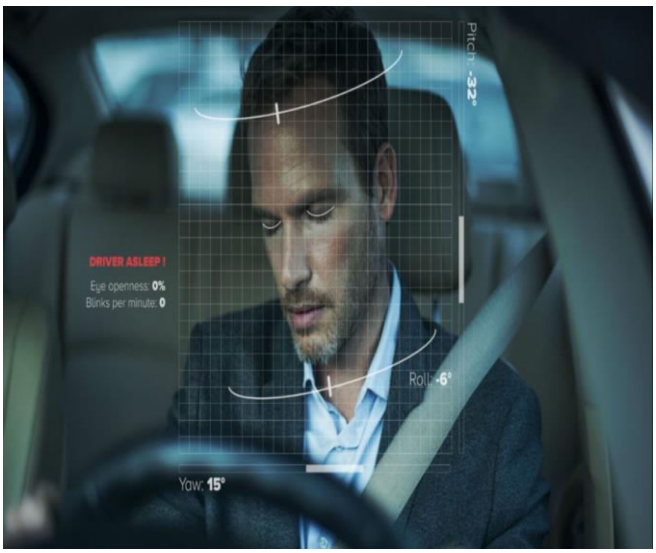

Fig. 1. Drowsiness while Driving [6]

Driver assistance framework advancement have been needed to forestall the mishaps because of driver drowsiness, since all the time he can't handle the vehicles a few dangers may happed because of driver's sluggishness, or

negligence. This framework assists with bringing the consideration of a driver. Normally the consequence of drowsiness and interruption is when driving unrealistic to give the consideration on driving it is identified with the level of non fixation. Driver nodding off the languid driver identification framework distinguishes the tired and drowsiness of the driver and it offers cautioning to the driver. There are numerous advances are accessible to distinguish the driver drowsiness and every strategy with its own constraints.

II. RELATED WORKS

A. *Related Works*

Fouzia et al. [7] proposed a framework that presents a drowsiness detection structure dependent on shape indicator calculation, that recognizes the eyes, and furthermore checks the eye flicker rate followed by drowsiness detection at continuous. In the proposed framework, the insights regarding the eye status is gotten through image processing calculations, which offer a non-intrusive way to deal with recognize drowsiness with no inconvenience and obstruction. In future, the detection of yawning of the driver can be likewise be carried out utilizing same casing work for identifying further insights regarding the drowsiness of driver. Precisely, the proposed system is to detect closed eyes to observe drivers fatigue and alert the driver with a buzzer and vibration on positive detection. During monitoring, the system is able to decide whether the eyes are open, closed or drowsy. When the eyes were detected closed for too long, a warning signal is issued. This was done by mounting a camera in front of the driver and continuously capturing its real-time video using Open CV in Raspberry Pi. Driver drowsiness can be determined from several symptoms that manifest in drowsy drivers face. Through the analysis of the eye status, the system will be able to tell whether the driver is drowsy or not. Initially when the camera is in on state, video streams are continuously captured from the drivers face. To detect the eye blink, the current state of the eye is needed which is either open or closed. If the state of eyes changes from closed to open, it indicates an eye blinking. If the state of the eyes is in closed state for a certain amount of time then the person is detected as drowsy and shape predictor is used to predict the state of the driver's eye. If a drowsy driver is detected a buzzer sound and the vibration is raised, until the driver is alert. To evaluate the proposed method, Raspberry pi-B module 3 is used as a preprocessor, which processes the images. Raspberry pi has an SD card inserted into the slot on the board which acts as the hard drive for the Raspberry Pi. It is powered by USB and the video output can be hooked up to a traditional RCA TV set, a modern monitor, or even a TV using the HDMI port. The web camera is used to detect the eye of the driver, the data collected from the camera is sent to the Raspberry pi, after data processing, if the driver is drowsy then he/she will the alerted with vibrator which is placed under the driving seat.

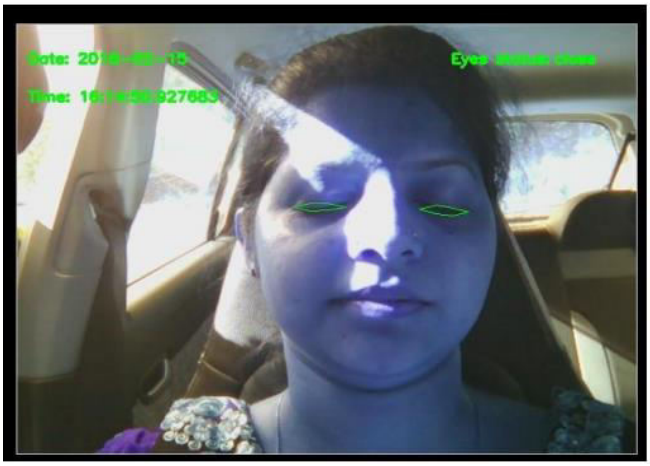

Fig. 1. Drowsiness Detection [7]

Federico Guede-Fernández et.al. [8] proposed a technique to give a certainty quality level of the respiratory sign. Also, the acquired quality sign level has been joined with the drowsiness detection calculation to improve the arrangement results through lessening the quantity of bogus positives because of changes of estimated RRV related not to drowsiness but rather body developments or talking. Moreover, the planned calculation has been approved under a driving test system and a few drowsiness scenes have been distinguished for every last one of 15 test meetings. The best quality level of drowsiness occasions has been produced by outer eyewitnesses from video chronicles of the subject while driving. The presentation results have been gotten following LOSOCV system to accomplish an impartial gauge of the summed up calculation execution. The improvement of drowsiness arrangement results because of the sign quality calculation has been additionally surveyed and the distinctions for every advancement models and AT have been talked about. To survey the exactness of the proposed drowsiness identification calculation, the volunteers of the investigation should drive while they are battling against to nod off. Since these circumstances might be perilous for volunteers, the test was vehicle ried on a driving test system lodge under controlled conditions. Additionally, test conditions have been intended to notice the conduct of drivers in their battle against to nod off while driving. From one viewpoint, the trial convention is centered around drowsiness discovery while driving in notable hard conditions to keep readiness: night hours, exhausting and relatively less jam-packed roadways. This convention has been set up with a front screen inside a test system with vehicle bodywork to give a vivid involvement with the offices of the Organization of Biomechanics (IBV) in Valencia, Spain as displayed in Fig. 1a. The vehicle was furnished with pedals, directing haggle transmission. A projector was utilized to show a virtual situation on a screen before the vehicle. The trials were directed with the room environment control to 24◦C, low lighting and with parkway sounds. The reenactment situation was a two-route roadway with two paths toward every path, low thickness of traffic, night climate, and way with no sharp bends. Besides, a

camcorder, which has been centered around the subject's head, has recorded the examination. The camera gadget used to record video was the Logitech webcam C120. Video accounts were utilized by a few outside spectators to produce the ground truth driver drowsiness signal. Members have played out the driving tests in two distinct days. In one of them, the subject had sleep hardship for the last evening so subjects have not dozed in the 24 hours before the analysis. The other analysis occurred with the ordinary sleep circumstance, so subjects probably rested somewhere around 6 hours the night prior to the test. The two conditions were randomized and the tests were performed at the hour of day at 9 a.m. Then, at that point, the distinction between the two investigations was the subjects' underlying sleep condition. Subjects were approached to stay in the test system vehicle seat, wearing a safety belt and keeping two hands on the directing wheel with the two feet in the pedals. During the initial 5 minutes of the test, subjects were approached to stay still and calm. From that point onward, they were approached to drive the test system vehicle for 90 minutes. At long last, they were approached to stay situated in the driving test system with their eyes shut for 5 minutes. Akshay Bhaskar et al. [9] proposed EyeAwake in its flow stage makes a decent gadget for sluggish driver detection and giving essential vehicle adjustment as far as easing back down and in the long run halting the vehicle. The model expense roughly US$40 to construct and test. To keep the expense low, a basic plan was followed which utilizes fundamental yet precise sensors. By utilizing various such sensor segments, detection of sluggish driving was genuinely precise. Beginning on street tests show a 70% exactness in distinguishing lazy driving. Besides, EyeAwake has remarkable highlights that most existing items don't like outside notice to different drivers and people on foot, and a fundamental vehicle revision instrument. At first, every one of the sensors were independently tried for wanted usefulness. Loads of adjustment was done in this stage to eliminate whatever number bogus positives as would be prudent. Note that this alignment is finished regarding singular drivers and can't be summed up. This is because of the way that various drivers have various qualities, for example, skin tone, stature, resting heart/breathing rate and so forth Contingent upon the driver's physiology and conduct, the limit esteems referenced in the above segment are set. After all sensors finished the above assessment, they were coordinated to shape EyeAwake. The EyeAwake model was first tried in a lab under ideal working conditions. On a normal, 80% precision was accomplished by EyeAwake in the lab. Nonetheless, a couple of bogus positives figured out how to crawl into the framework. After lab testing, EyeAwake was conveyed in vehicles which were driven by transporters and taxi drivers during night shifts. The truck and taxi drivers were at first distrustful as they had been important for comparative item tests before. Notwithstanding, with a precision of around 70% on road, they were intrigued by the item. The two fundamental highlights of EyeAwake they appreciated were: I. the capacity to back off and in the end stop the vehicle ii. outside warnings to different drivers and people on foot when lazy driving was recognized. Besides, they gave positive audits with respect to the convenience of EyeAwake and the minimal expense. Xiaoxi Mama et al. [10] proposed a driver fatigue detection framework dependent on CNN utilizing profundity video groupings is proposed. To use the spatial and worldly data for profundity based activity acknowledgment issue, another engineering called profundity video-based two-transfer CNN is proposed. In addition, a foundation expulsion framework for profundity video arrangement of driving is proposed.

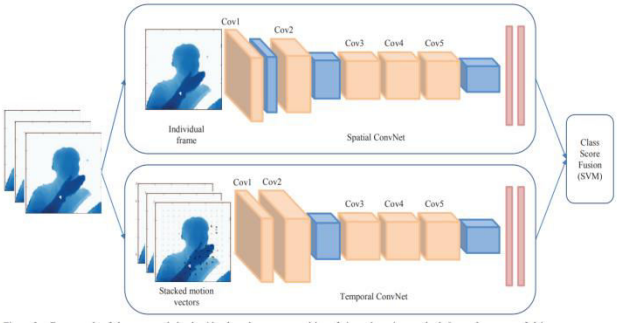

Fig. 2. Framework [10]

The proposed strategy can viably distinguish whether the driver is fatigue driving or ordinary driving during the evening, with an exactness of 91.57%, utilizing our gathered profundity based driver fatigue dataset. Our framework can be utilized to give cautions appropriately to fatigue drivers, which will diminish and forestall the event of car crashes. Aldila Riztiane et al. [11] proposed a framework that planned to alarm drivers so they can be advised to pull over and quit driving in a lazy state. The application "Driver Drowsiness Detection" uses Haar-course Detection just as layout coordinating in OpenCV to recognize and follow the eyes utilizing the front camera of an Android gadget. Testing has been directed to guarantee that the usefulness, conduct, execution and client fulfillment are true to form. Despite the fact that, the information got by the application actually has a few limitations, explicitly in relationship to adequate lighting and haziness of the face and eyes territory, the application has effectively identified the eye flickers at the point of 30 to 60 degrees and distance of 20-50 cm, just as estimating the pulse. The framework plan for drowsiness discovery application can be summed up as follow. In the first place, the driver will be approached to gauge their pulse utilizing the wearable gadget to get the ordinary resting pulse, as it contrasts for each person. When the estimation has been saved, it's anything but a boundary to decide the worth demonstrated as would be expected, Tired, or Sleeping. These qualities will be procured after the pulse estimation testing to decide the drop esteem from ordinary pulse to sleepy. When the estimation is taken and saved, the driver will actually want to begin the application which will recognize the face, and essentially the eyes space of the driver. The application will identify the condition of the eyes, regardless of whether it is closed or open. The two boundaries, which are the pulse and the condition of the

eyes will then, at that point be consolidated to decide if the driver is sorted to being sleepy or not. To run the use of Driver Drowsiness Location, there are two gadgets required. The first is an Android-based cell phone with front camera, and second an Android Wear-based wearable gadget. There are likewise prescribed equipment and programming details to guarantee that the application runs as wanted. The gadgets used to run Driver Drowsiness Application should be arranged not exclusively to guarantee the most noteworthy productivity, yet in addition not upsetting the client, which needs to utilize the application while driving. The main gadget, which has the front camera, is put in front with the goal that it's anything but an unmistakable perspective on the client's facial highlights. The distance and point of the situation will be resolved in the wake of testing is led. The gadget can be put some place on the dashboard of the vehicle utilizing a telephone holder explicitly intended to be utilized in the vehicle. The layout coordinating with strategy returns a worth called minVal to track down the most obscure space of a picture, which if there should be an occurrence of a face, is the understudy of the eyes. Consequently, the way toward identifying squint could depend upon the presence of such worth. The worth won't be returned when the eyes are shut, since it's anything but identified. At the point when the eyes are open, it will go from 0 to 5. The minVal will then, at that point be one of the concluding conditions to trigger the caution. Nonetheless, the squint span additionally should be considered to decide Drowsiness. The flicker span of a sleepy individual is supposed to be around 0.6 seconds, thus the worth that will be utilized for the application will be 0.6 seconds. A commencement clock capacity will be initiated to tally whether the minVal has dropped out of reach for a time of 0.6 seconds. At the point when such condition has been met, the application will check for one more condition, which is the pulse, to decide Drowsiness and setting off the application. Since there is no precise pulse esteem that can be applied as a norm to each person, testing for the sole reason for this application will be directed to decide the drop of a person's pulse between three phases; ready, lazy, and sleeping. The pulse esteem, estimated in beats each moment (bpm) will be another central consideration to trigger the alert.

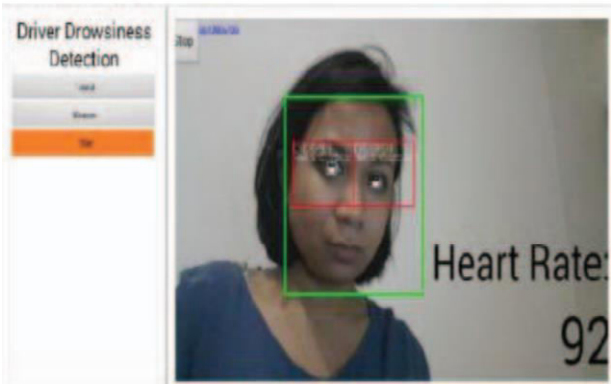

Fig. 3. Proposed Work API [11]

Sanya Gupta et al. [12] proposed a work which is tried and checked to give high exactness in the dynamic of the driver's lazy conditions. Simultaneously, the framework achieved a few execution boundaries of ongoing designs in cars. The framework gave in this paper is convenient, since it doesn't need a force source from a PC and should be associated with a PC just at the hour of setup of the framework. Since the framework deals with the standard of equal processing which definitely decreases the processing time needed by the framework to give the choice, it makes it an ongoing arrangement. Also, FPGA is an adaptable gadget that can be totally reconfigured for higher or better calculation. The working of individual modules was tried independently just as all together, and the outcomes were gotten true to form. The slope bend gives the minima on x position relating to one side of the face and maxima on x position comparing to the right half of the face. The eye recognition module yield is shipped off Intricacy module where the intricacy of the picture is assessed, contrasted and the edge and a choice is given that the eye is open. For head bringing down module, the principal outline is extricated and prepared. Rest of the casings are likewise prepared comparatively and number of face pixels for each situation are contrasted with the primary edge with decide head bringing down. One such handled edge with head brought down. The framework created in this paper is tried and checked to give high precision in the dynamic of the driver's lazy conditions. Simultaneously, the framework achieved a few execution boundaries of continuous designs in autos. The framework gave in this paper is convenient, since it doesn't need a force source from a PC and should be associated with a PC just at the hour of setup of the framework. Since the framework chips away at the standard of equal preparing which definitely diminishes the handling time needed by the framework to give the choice, it's anything but a constant arrangement. What's more, FPGA is an adaptable gadget that can be totally reconfigured for higher or better calculation. However, the test that remains is to make the framework savvy utilizing miniature regulators since FPGA is an exorbitant gadget. Besides, the framework created expects the foundation of the driver to be basic. On the off chance that a confounded foundation is introduced behind the driver, the framework will in general settle on a mistake in the choice. Another downside of the framework is that it doesn't consider head shifting to be an indication of driver drowsiness yet it gives apparent outcomes as far as alarming the diverted driver, turning his head left or ideal for term past the limit time. So the future work will comprise of eliminating this load of downsides and difficulties and taking other indication of drowsiness like yawning and head shifting into thought also.

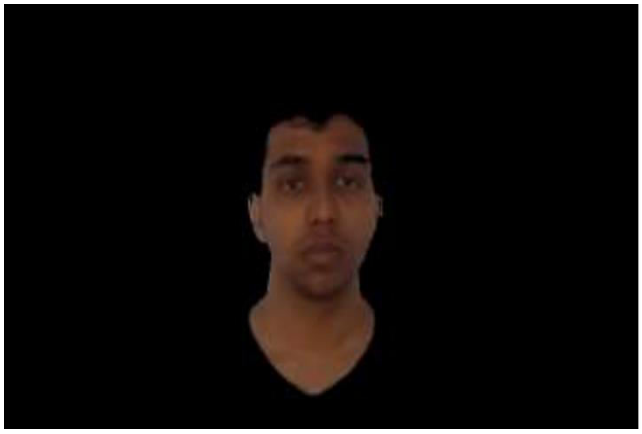

Fig. 4. Processed First Frame [12]

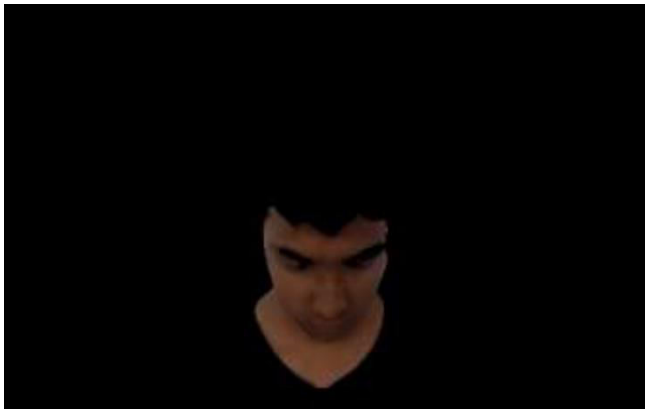

Fig. 5. Processed Last Frame [12]

III. CONCLUSION & FUTURE SCOPE

The systems which have been proposed till now are not very much reliable because those systems are not efficient to extract the useful information. The information is missing the sensitive edges that trail the accuracy in order to achieve the correct recognition. Most of the systems are based on single frame decision and not analyzing the consequent frames for correct decision. System required proper analysis for attaining the best level of accuracy. Automatic Drivers Drowsiness Detection is a useful concept for implementing safe driving that may aware drivers for any type of accidental casualties. The aim of this study is to address a solution to one of the major causes of the road accident, the driver drowsiness; the proposed solution does track the driver's eyes and then notify him when his eyes get closed in order to avoid losing the control of the car and causing traffic accidents. If the result of the classification indicates that the driver's eyes is closed for a predefined period of time, the eyes of the driver will be considered closed and hence an alarm will be started to alert the driver. Accuracy is very important with respect to the correct and incorrect recognition for ideal system. In future, a system can be implemented that pertains the best accuracy with minimal error rate that works effectively at real time. This system cab be enhanced in future where accuracy depends by appending various tensorflow based packing that works effectively in computer vision especially in real time.

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